Replace Multi Mineral Oil Recovery Work Manual PUHY-YREM-A

This product is designed and intended for use in the residential, commercial and light-industrial environment.

The product at hand is based on the following EU regulations:

- Low Voltage Directive 73/23/EEC
- Electromagnetic Compatibility Directive 89/336/EEC
- Pressure Equipment Directive 97/23/EC

Please be sure to put the contact address/telephone number on this manual before handing it to the customer.

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Changes for the Better

2004

Replace MULTI

Mineral Oil Recovery Work Manual

For R407C Refrigerant

Cautions For REPLACE MULTI Installation Work

Flow of installation work in the field

Items to be observed

Before local installation work

Confirming the possibility of existing refrigerant piping for reuse

- Please note that our Corporation is not liable to the reliability of existing piping, wiring and power system for reuse (in relation with the gas leak of piping, partially defective/disconnection of wiring, deteriorated insulation, characteristic faults due to worn out system).

Confirming the possibility of existing control wiring for reuse

- For limitation on the refrigerant piping and applicable piping diameter, check the existing piping for reuse in accordance with the specified check sheet by referring to product catalogs and this manuals for judgement to reuse.

Confirming the possibility of existing power source system for reuse

- If vapor condensation was found in the past, check the thermal insulation.
- Any portion suffering condensation dripping, check the deterioration of the insulation, and repair the insulation materials if required.

Confirming the objective range for replacing

- When the copper piping is seriously deteriorated, do not use parts with verdigris or black spots.
- For reusing the existing control wiring between the outdoor unit, and remote controller, check the wire type, size or the like, based on the check sheet to judge the possibility.
- Even when the above does not meet the item on the check sheet, existing wiring may be reused depending on the number of connecting indoor units and piping length. Ask us for details.
- For the power source system, employ the voltage and number of phase meeting the outdoor unit, indoor unit and adopt the breaker capacity and wiring size based on the power source wiring connection diagram.
- When the existing power source system (including the power source wiring) is used, check the system for deterioration and damages.

During local installation work

Recovering the refrigerant of old system

- Check the refrigerating machine oil used in the existing system. (As is found at the oil inspection), if the refrigerating machine oil used in the existing system is mineral oil, use the ester oil sampling kit for inspection.
- When the length of piping for reuse is unknown, additional refrigerant charge is to be calculated based on the quantity of recovered refrigerant. For this reason, you are kindly requested to recover all refrigerant inside the existing outdoor/indoor units and extended piping to check and record the quantity. (The standard of additional refrigerant is (Quantity of R22 recovered - Charged quantity of existing outdoor unit + 3kg). Adjust the refrigerant quantity after mineral oil recovery operation.)

Removing the outdoor/indoor units, remote controllers, etc.

Installing the outdoor/indoor units, remote controllers, etc., and executing electrical work

■ Outdoor unit

- Confirm the space around the outdoor unit.
  (Verifying the installation space of the oil trap kit)

Setting the address, checking the system

■ Turn the power source on, and confirm the normality of the system

- Check the remote controller or outdoor unit for error display.
- Run the indoor unit for fan operation after turning the remote controller on, and check the air feeding and direction.

Do not run the compressor until finishing the mineral oil recovery operation.

Executing the piping work (mounting of ball valve).
Air tightening and evacuating the existing piping and charging refrigerant

■ Mount the valves to the field piping (extended piping). (The ball valve is attached to the outdoor unit.)
■ Execute an airtight test to check the existing piping for deterioration or leaking.
■ Calculate the quantity required by the extended piping, and charge the additional refrigerant. Make sure to enter the value in the additional refrigerant charge column on the label of the outdoor unit.
■ If the refrigerant charge is insufficient, enter the value also.

Without applying any operation, keep the ball valves of the outdoor unit closed before mineral oil recovery operation.

Enter required items in the request form of REPLACE MULTI mineral oil recovery work.

Operating mineral oil recovery

Executing test run and adjustment (for final verification of operation).

It is necessary to charge refrigerant in a rated quantity and adjust the quantity.
Be sure to execute when the piping length is unknown.
For detail, consult the agent of your dealer.

Safety Precautions

- **Before installing the unit, make sure you read all the "Safety precautions".**
- **The "Safety precautions" provide very important points regarding safety. Make sure you follow them.**

Symbols used in the text

⚠ Warning:

Describes precautions that should be observed to prevent danger of injury or death to the user.

⚠ Caution:

Describes precautions that should be observed to prevent damage to the unit.

Symbols used in the illustrations

⃠ : Indicates an action that must be avoided.

: Indicates that important instructions must be followed.

: Indicates a part which must be grounded.

⚠ : Beware of electric shock (This symbol is displayed on the main unit label.) <Color: Yellow>

⚠Warning:
Carefully read the labels affixed to the main unit.

⚠ Warning

Ask your dealer or specialized contractor for installation.

- If your own installation work is improper, fire, electric shock or water leakage may result.

Connect wiring using the specified cable and fasten it securely to prevent the external force of the cable from being transferred to the terminal connecting sections.

- Improper connection or fastening may cause heat generation or fire.

Conduct specified installation work durable against strong winds around buildings.

- Improper installation work can cause trouble i.e. the unit toppling over.

Never attempt to repair the unit. For repair, ask your dealer.

- Improper repair may result in water leakage, electric shock or fire.

Do not touch the heat exchanger fins.

- Improper handling may cause cuts.

When refrigerant gas is leaked during work, conduct ventilation.

- If refrigerant gas comes into contact with fire, it may cause the generation of poisonous gases.

Please conduct correct installation work by observing this Installation Manual.

- Improper installation work may result in water leakage, electric shock or fire.

Conduct all electrical work by a licensed engineer according to "Technical Standard relating to Electrical Facility," "Wiring Regulation of Power Company," and instructions in this Manual, and always use an exclusive circuit.

- Insufficient power source capacity or improper installation may cause electric shock or fire.

When installing or moving the unit, do not charge other than the specified refrigerant (R407C) into the refrigeration cycle.

- Air if mixed generates abnormally high pressure inside the refrigeration cycle which may damage the unit.

Do not reconstruct or reset the protection devices.

- If the protection devices like the pressure switch or thermal switch is forcibly operated by short circuiting, or parts other than that specified by Mitsubishi Electric are used, fire or explosion may be caused.

Before Conducting Mineral Oil Recovery Operation

⚠ Caution

Turn the power source on 12 hours or more before starting operation.

- Otherwise trouble may be caused. Do not turn the power off during the operating season.

Do not operate the unit without the panels or guard.

- Touching the rotating parts, high temperature parts or high voltage may cause personal injury such as burns or electric shock.

Do not operate switches with wet fingers.

- Electric shock may be caused.

Do not turn off the power source immediately after stopping.

- Be sure to wait for 5 minutes or more. Otherwise water leakage or troubles may be caused.

Do not touch the refrigerant piping during operation or immediately after stopping with bare hands.

- The refrigerant piping or the refrigerant circuit parts of the compressor during operation or immediately after stopping may have low or high temperature. Touching with bare hands may cause a burn or frostbite.

Do not run the outdoor unit during a test run until finishing the mineral oil recovery operation.

- The indoor unit fan will run.

Caution to Mineral Oil Recovery Operation

⚠ Warning

Be sufficiently careful to avoid the oil trap kit, falling or toppling over.

- If this happens the oil trap kit may be damaged and refrigerant piping may malfunction.
- Falling down during flushing operation causes the leak of refrigerant from the joint which is dangerous if contacts it human body.

After flushing operation, check the residual pressure inside the oil trap kit with a pressure gauge. If the residual pressure is exceeding 0.294MPa, recover refrigerant inside the oil trap kit to reduce the pressure to within 0.2 ~ 0.294MPa.

- Under high inner pressure, pressure rises during storing, inducing a dangerous situation.
- Under low inner pressure, water content or foreign matter enters during storing, causing corrosion to the oil trap kit which may cause troubles.

Be careful not to expose the oil trap kit unit (especially electrical parts) to rain water.

- The electrical parts if wet with rain water may cause machine trouble.
- The electrical parts if wet with rain water may cause electrical shock.

Conduct oil recovery from the oil recovery service valve outdoor or at a place with good ventilation. Use leather gloves when opening the oil recovery service valve and open it slowly.

- If done in a closed space, suffocation can be caused.
- Opening the oil recovery service valve fully and quickly allows oil to splash, which is dangerous.
- As the oil recovered is of low temperature, frostbite may be caused if it touches skin.

⚠ Caution

When the oil trap kit is transported while lying sideways, do not place any thing on the sheet metal of the kit.

- Otherwise, the sheet metal or inner piping may be deformed leading to breakage.

Before removing the oil trap kit after flushing operation, make sure to discharge and process the oil recovered from the oil recovery service valve.

- If it is not discharged, the oil accumulated inside will flow out during flushing operation hindering proper recovery of mineral oil thus leading to machine trouble.

For inspection, use the ester oil sampling kit when the refrigerating machine oil used in the existing unit is mineral oil.
(Confirm the type of refrigerating machine oil used in the existing unit by reading the name plate or the like.)

- Proper checking can not be executed if not using the kit meeting the refrigerating machine oil used by the existing unit. This possibly causes machine trouble.

Precautions for Devices that Use R407C Refrigerant

⚠ Caution

Use refrigerant piping made of phosphorus deoxidized copper and copper alloy seamless pipes and tubes. In addition, be sure that the inner and outer surfaces of the pipes are clean and free of hazardous sulphur, oxides, dust/dirt, shaving particles, moisture, or any other contaminant.

- Contaminants on the inside of the refrigerant piping may cause the refrigerating machine oil to deteriorate.

Store the piping to be used during installation indoors and keep both ends of the piping sealed until just before brazing. (Store elbows and other joints in a plastic bag.)

- If dust, dirt, or water enters the refrigerant cycle, deterioration of the oil and compressor trouble may result.

Use ester oil, ether oil or alkylbenzene (small amount) as the refrigerating machine oil to coat flares and flange connections.

- The refrigerating machine oil will degrade if it is mixed with a large amount of mineral oil.

Use liquid refrigerant to seal the system.

- If gas refrigerant is used to seal the system, the composition of the refrigerant in the cylinder will change and performance may drop.

Do not use other refrigerant other than R407C.

- Use of other refrigerants (R22 for example) may deteriorate refrigerating machine oil due to chlorine generation.

Use a vacuum pump with reverse flow protection.

- Otherwise the vacuum pump oil will reversely flow into the refrigerant circuit causing the possible deterioration of the refrigerating machine.

Do not use the following tools used for conventional refrigerant.
(Gauge manifold, Charging hose, Gas leak detector, Reverse flow protector, Cap for refrigerant charge, Refrigerant recovery device)

- Mixing of conventional refrigerant /refrigerating machine oil may cause to deteriorate the refrigerating machine oil.
- Mixing with water may cause deterioration of the refrigerating machine oil.
- As this refrigerant does not contain chloride, the gas leak detector for conventional refrigerant gas can not be used.

Do not use a charging cylinder.

- Use of a charging cylinder changes the composition of refrigerant resulting in possible performance deterioration.

More careful management is required for the tools than that for the conventional.

- Dust, trash or water content if mixed into the refrigerant circuit may cause to deteriorate the refrigerating machine oil.

Caution to Equipment Used for Replacing

⚠ Caution

Do not operate the valve before conducting mineral oil recovery operation.

Operating valves before conducting mineral oil recovery operation may cause a deterioration in the performance of mineral oil recovery.

For mineral oil recovery operation, the system controller and MA remote controller may be required to be remove sometimes.

- Improper handling can lead to an inability to perform oil recovery operation.
- For removal, follow the instruction displayed on the PC for mineral oil recovery.
- Mount the controllers again after finishing the oil recovery operation.

Observe a safe distance from the indoor unit fan which runs during the mineral oil recovery operation.

Working in the surrounding of the indoor unit fan can cause personal injury.

Record the quantity of refrigerant replenished. (Enter into the column for replenished refrigerant quantity on the label of the indoor unit.)

- Missing the description may deteriorate the performance of mineral oil recovery.
- Malfunction or poor cooling/heating may also be caused.

During the mineral oil recovery operation, an error display may be shown on the remote controller or system controller.

- When an error display was shown during mineral oil recovery operation, reset the error display after finishing the operation.

To conduct the refrigerant recovery/evacuation of the inside of exiting piping, choose tools only used with R407C e.g. charging hose.

- Using a charging hose for R407C causes it to mix the conventional refrigerating machine oil leading to the deterioration of refrigerating machine oil.

Before Conducting Installation Work/Electrical Work

⚠ Caution

Do not install the unit at a place where combustible gas can possibly be generated.

- Leaked combustible gas if stagnated around the unit may cause explosion.

Do not use the unit in a special atmosphere.

- Use in an atmosphere containing high levels of oil, steam or sulfide gas may seriously degrades the performance or damage parts.

Do not install the unit on a material which is not designed to be wet.

- If liquid drips from the oil trap kit, apply centralised drainage work to the oil trap kit.

Apply grounding work securely.

- Do not connect the grounding line to gas pipe, city water pipe, lightning rod or telephone grounding line. Improper grounding may cause electric shock.

For the power source wiring, refrain from giving tensile force to the wiring.

- Disconnection, heat generation or fire may be caused.

Make sure to mount a leak breaker to the power source.

- Otherwise electric shock may be caused.

Be sufficiently careful in transporting products.

- Do not transport a product with a weight exceeding 20kg by a single person.
- Some products are packed with PP band. Do not use it as a means of transporting.
- During transport cuts may be caused by the fin surface of the heat exchanger, please refrain from touching it without gloves.

Do not use the same switch or the like for plural outdoor units.

Otherwise, malfunction, heat generation or fire may be caused.

Be sure to mount the valve to the field piping (extended piping).

After mineral oil recovery, the oil trap kit can not be removed disabling air conditioning operation.

When installing the unit in hospitals or communication equipment plants, prepare measures to prevent noise generation beforehand.

- The noise may cause the erroneous operation or failure and may give negative effect to medial equipment or communication equipment to disturb medical treatment on human bodies or hinders image broadcasting or generates noise.

Check possibility for the reuse of existing refrigerant piping by observing this manual.

- The conventional refrigerating machine oil is contained inside existing piping and some residual oil deteriorates oil recovery performance which may lead to the deterioration of refrigerating machine oil.
- The piping specification (diameter, length , height difference) out of the use specified range may hinder the mineral oil recovery performance, possibly leading to deterioration of refrigerating machine oil.

Do not use breakers or fuses other than that with correct capacities.

- Use of a fuse with excessively large capacity or wire/copper wire may cause troubles or fire.

For the power source wiring, use wire with rated current capacity.

- Otherwise an electric leak, heat generation or fire may be caused.

When using existing wiring (for power source or transmission) or switches, check them for disconnection and deterioration beforehand.

- Otherwise an electric leak, heat generation or fire may be caused.

Dispose the packing materials properly.

- As the packing materials are using metal products or wooden pieces such as nails, nail wounds may be caused if it is improperly treated. Please observe caution to avoid this from occuring.
- Dispose the polyethylene bag for packing only after tearing. Otherwise a suffocation accident may be caused by children play with the disposed bag.

Provide thermal insulation to the valve on the field piping (extended piping) properly.

- Insufficient thermal insulation generates condensation that may cause to deteriorate the performance.
- Provide thermal insulation (including lagging) after recovering mineral oil.

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I. Judgment for Reuse of Existing Piping

Both the checking of gas leak inside existing piping and the verification of reliability relating to piping strength belong to the scope of field work as same as in the past. Therefore, we are not liable to the quality of existing piping.
Before starting the work, it is necessary to confirm that the existing piping in question owns the rated strength (relating to the material, thickness, and corroded portions, if any).

Points to be observed for simplified judgment to reuse existing piping

1. Reusing CITY MULTI air conditioner system

The existing piping can basically be reused if no problem was found during your use in the past.
(Please check whether the trouble was caused by gas leak or it required frequent refrigerant replenishment.)

(1) Change to same capacity → Usable as it is
(2) Change to different capacity → Check whether the piping diameter, piping length, height difference, etc. are within our operating range.

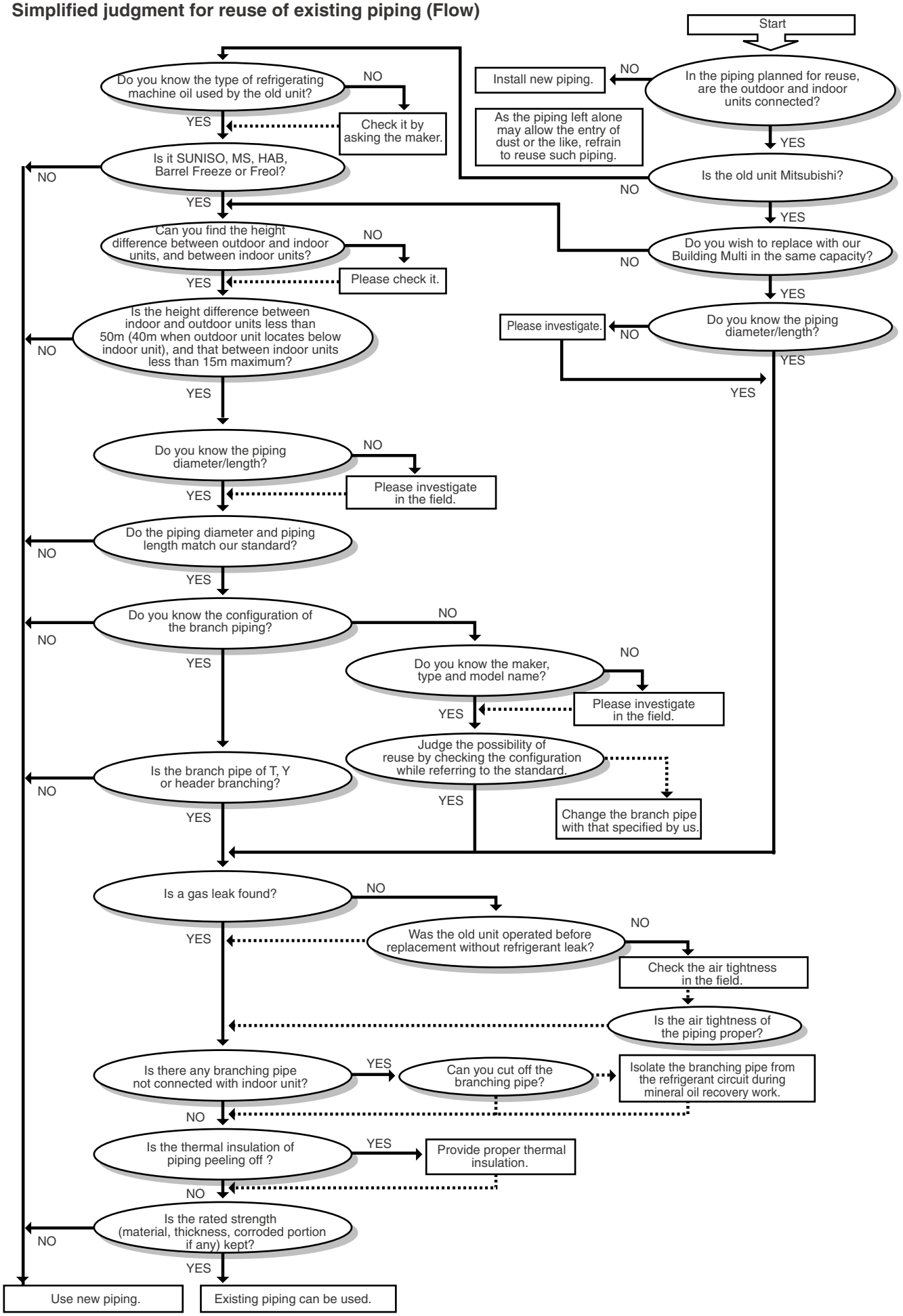
2. Reusing other makes or Mitsubishi other than CITY MULTI

(1) Check whether the packaged air conditioner used in the past was in operational trouble or not.
(Please check whether the trouble was caused by gas leak or it required frequent refrigerant replenishment.)
(2) Confirm the type of refrigerating machine oil used by the existing facility.
SUNISO, MS, HAB, Barrel Freeze, Freol are acceptable. For other refrigerating machine oil than the above, ask our factory in each case.
(3) The branch types of T-fitting, Y-branch and header branching are acceptable.
The branch pipe applied with pressure loss (like the multi-distributor of SLIM) can not be used. Replacement with new branch pipe is required in this case.
Estimate the branch configuration and piping size depending on the maker name, model name and connecting quantity of existing products.
(4) Confirm that the piping diameter, piping length, height difference, etc. are within our operating range.

Item, index of judgment for reusing of existing piping

Items	Judgment standard	Indirect material for judgment
Piping diameter, length	Refer to DATA BOOK	None
Type of refrigerating machine oil	SUNISO, MS, HAB, Barrel Freeze, Freol	Maker, type (model name), year of manufacturing
Air tightness	No pressure drop by leaving for one day after pressurizing to 2.98Mpa	Operability of previous unit
Distributor configuration	T-fitting, Y-fitting, Header branching	Maker, type (model name), year of manufacturing
Thermal insulation	No peeling off of thermal insulation and caulking	None
Piping system	Unit height difference should be within the standard of typical unit	None
Pipe thickness	Pipe thickness equivalent to the standard of each country	

Simplified judgment for reuse of existing piping (Flow)


Start
In the piping planned for reuse, are the outdoor and indoor units connected?
NO
Install new piping.
As the piping left alone may allow the entry of dust or the like, refrain to reuse such piping.
YES
Is the old unit Mitsubishi?
NO
YES
Do you wish to replace with our Building Multi in the same capacity?
NO
YES
Do you know the piping diameter/length?
NO
Please investigate.
YES
Do you know the type of refrigerating machine oil used by the old unit?
NO
Check it by asking the maker.
YES
Is it SUNISO, MS, HAB, Barrel Freeze or Freol?
NO
YES
Can you find the height difference between outdoor and indoor units, and between indoor units?
NO
Please check it.
YES
Is the height difference between indoor and outdoor units less than 50m (40m when outdoor unit locates below indoor unit), and that between indoor units less than 15m maximum?
NO
YES
Do you know the piping diameter/length?
NO
Please investigate in the field.
YES
Do the piping diameter and piping length match our standard?
NO
YES
Do you know the configuration of the branch piping?
NO
NO
YES
Do you know the maker, type and model name?
NO
Please investigate in the field.
YES
Judge the possibility of reuse by checking the configuration while referring to the standard.
YES
Change the branch pipe with that specified by us.
Is the branch pipe of T, Y or header branching?
NO
YES
Is a gas leak found?
NO
YES
Was the old unit operated before replacement without refrigerant leak?
NO
Check the air tightness in the field.
Is the air tightness of the piping proper?
Is there any branching pipe not connected with indoor unit?
YES
Can you cut off the branching pipe?
Isolate the branching pipe from the refrigerant circuit during mineral oil recovery work.
NO
Is the thermal insulation of piping peeling off ?
YES
Provide proper thermal insulation.
NO
Is the rated strength (material, thickness, corroded portion if any) kept?
NO
YES
Use new piping.
Existing piping can be used.

II. Connection Range of Deformed Piping

1. List of possibility to connect deformed piping (Chart)

(1) Outdoor – First branch [A section (Y series)]

Table-1

		P200	P250
Gas pipe	ϕ15.88	x	x
	ϕ19.05	x	x
	ϕ22.2	●	x
	ϕ25.4	◎	●
	ϕ28.58	❊	◎
	ϕ31.75	x	x
	ϕ38.1	x	x
Liquid pipe	ϕ9.52	x	x
	ϕ12.7	◎	◎
	ϕ15.88	△	△
	ϕ19.05	x	x
	ϕ22.2	x	x

◎ : Normal piping
○ : Usable (without performance deterioration)
● : Usable (with performance deterioration: Refer to DATA BOOK)
△ : Usable (with rule on refrigerant charge: Refer to the formula to judge refrigerant charge on the next page.)
▲ : Usable (with limitation on piping length)
◆ : Possible for liquid piping of ϕ9.52
x : Not connectable
❊ : Limitation on mineral oil recovery work process

This list is presented just for your reference, even the item marked x may be acceptable occasionally depending on the specific field piping condition. Therefore, please ask the factory individually in such case.

(2) Branch – indoor [a ~ f sections]

Table-2 List of possibility to connect indoor unit/deformed piping

		P20	P25	P32	P40	P50	P63	P71	P80	P100	P125	P140	P200	P250
Gas pipe	ϕ12.7	◎	◎	◎	◎	●	●	x	x	x	x	x	x	x
	ϕ15.88	x	x	x	◆	◎	◎	◎	◎	●	●	●	x	x
	ϕ19.05	x	x	x	x	x	○	○	○	◎	◎	◎	x	x
	ϕ22.2	x	x	x	x	x	x	x	❊	❊	❊	○	●	x
	ϕ25.4	x	x	x	x	x	x	x	x	x	❊	❊	◎	●
	ϕ28.58	x	x	x	x	x	x	x	x	x	x	x	○	◎
	ϕ31.75	x	x	x	x	x	x	x	x	x	x	x	x	x
	ϕ38.1	x	x	x	x	x	x	x	x	x	x	x	x	x
Liquid pipe	ϕ6.35	◎	◎	◎	◎	▲ (within 25m)	▲ (within 15m)	x	x	x	x	x	x	x
	ϕ9.52	△	△	△	△	◎	◎	◎	◎	◎	◎	◎	x	x
	ϕ12.7	△	△	△	△	△	△	△	△	△	△	△	◎	◎
	ϕ15.88	△	△	△	△	△	△	△	△	△	△	△	△	△
	ϕ19.05	x	x	x	x	x	x	x	x	x	x	x	x	x

Formula to judge refrigerant charge:

For the case marked △ , it is necessary to take measures to reduce the piping length slightly, to raise the selecting model or reduce the number of connected indoor units.

• Y series

M = 0.3 x L1 + 0.2 x L2 + 0.12 x L3 + 0.06 x L4 + 0.024 x L5 < 17.4

L1 : Piping length (m) of ϕ19.05mm
L2 : Piping length (m) of ϕ15.88mm
L3 : Piping length (m) of ϕ12.7mm
L4 : Piping length (m) of ϕ9.52mm
L5 : Piping length (m) of ϕ6.35mm

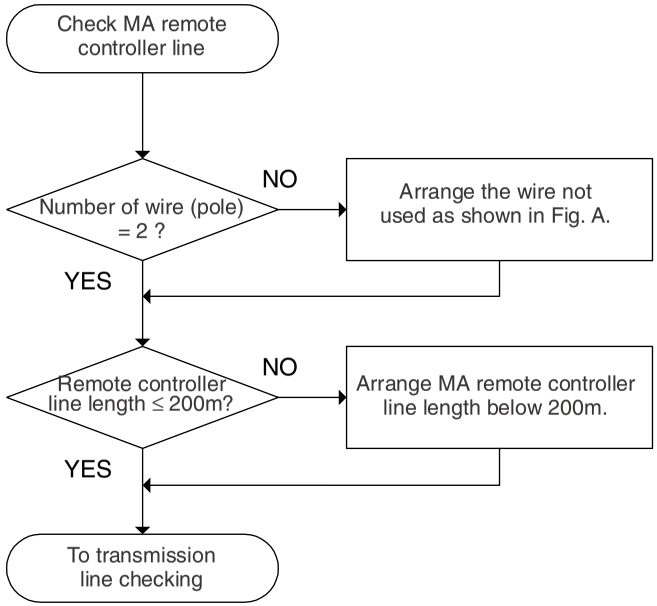
III. Judgment for Reuse of Existing Transmission Line Wiring

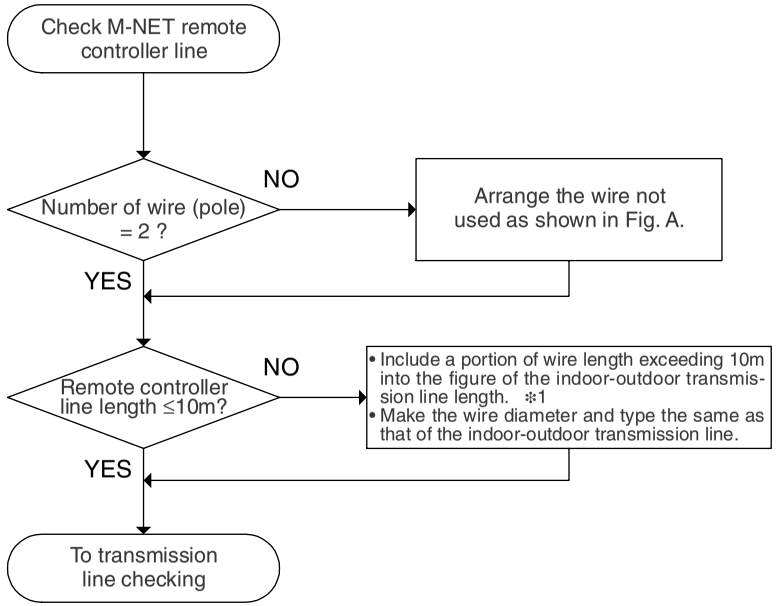
To study on the reuse of existing transmission line, please refer to the flow shown later starting from the next page.
For the reuse of existing transmission line, enter the necessary items into the check list, obtain the system diagram and contact our dealer.

Check list for reuse of existing transmission line wiring

Checking item	Result	Remarks
1. Remote controller line (MA remote controller)		
(1) Length	m	
(2) Wire diameter	mm^2	
(3) Number of wire (number of pole)	Pole	
(4) Type of wire (Shielded wire used/not used)	Used / Not used	
2. Remote controller line (M-NET remote controller)		
(1) Length ❇1	m	
(2) Wire diameter	mm^2	
(3) Number of wire (number of pole)	Pole	
(4) Type of wire (Shielded wire used/not used)	Used / Not used	
3. Remote controller line (System controller)		
(1) Length ❇1	m	
(2) Wire diameter	mm^2	
(3) Number of wire (number of pole)	Pole	
(4) Type of wire (Shielded wire used/not used)	Used / Not used	
(5) System controller connection Indoor system/centralized system	Indoor / Centralized	
4. Indoor-outdoor transmission line		
(1) Refrigerant system Single/Plural	Single / Plural	
(2) Transmission line farthest length ❇1	m	
(3) Wire diameter	mm^2	
(4) Number of wire (Number of pole)	Pole	
(5) Type of wire (Shielded wire used/not used)	Used / Not used	
(6) Number of connected indoor units	Unit	
5. Centralized transmission line		
(1) Transmission line farthest length ❇1	m	
(2) Wire diameter	mm^2	
(3) Number of wire (Number of pole)	Pole	
(4) Type of wire (Shielded wire used/not used)	Used / Not used	
6. Availability of system diagram (Please try to obtain it much as possible.)	YES / NO	
7. Existence of noise trouble on the unit before replacement (In case of YES, enter the trouble detail into the column of remarks.) ❇2	YES / NO	
8. Is the noise generation from high harmonics medical equipment estimated? (In case of YES, enter your apprehensions in detail into the column of remarks.) ❇2	YES / NO	

❇1 Include the portion of the remote controller length (M-NET/System controller) exceeding 10m into the figure of the transmission line length (Indoor-outdoor, centralized).
❇2 Regarding the judgment and countermeasure on noise, please contact our dealer.


Check MA remote controller line
Number of wire (pole) = 2 ?
NO
Arrange the wire not used as shown in Fig. A.
YES
Remote controller line length ≤ 200m?
NO
Arrange MA remote controller line length below 200m.
YES
To transmission line checking


Check M-NET remote controller line
Number of wire (pole) = 2 ?
NO
Arrange the wire not used as shown in Fig. A.
YES
Remote controller line length ≤10m?
NO
• Include a portion of wire length exceeding 10m into the figure of the indoor-outdoor transmission line length. ✻1
• Make the wire diameter and type the same as that of the indoor-outdoor transmission line.
YES
To transmission line checking

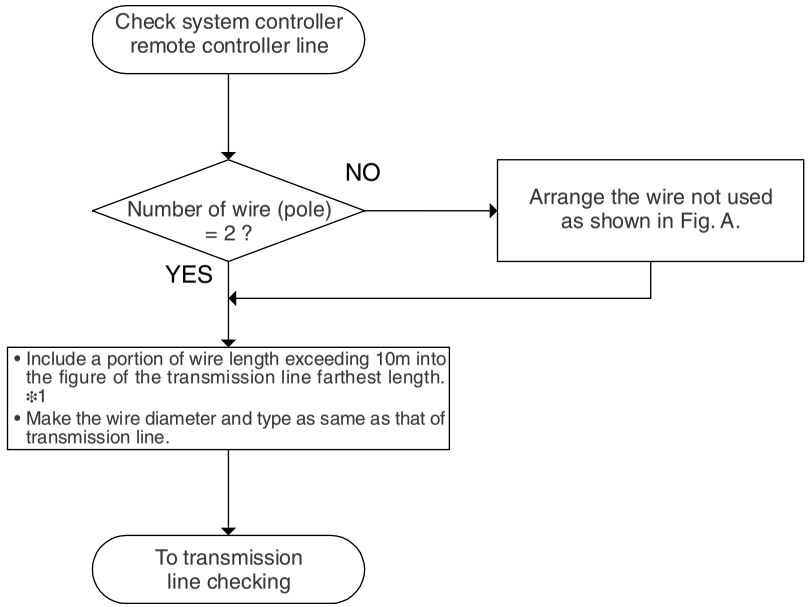
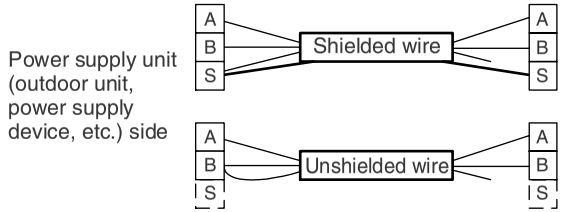

Check system controller remote controller line
Number of wire (pole) = 2 ?
NO
Arrange the wire not used as shown in Fig. A.
YES
• Include a portion of wire length exceeding 10m into the figure of the transmission line farthest length. ✻1
• Make the wire diameter and type as same as that of transmission line.
To transmission line checking

Fig. A Arrangement of wire not used



For the power supply unit (outdoor unit, power supply device, etc.) side, connect shielded wire to the terminal for shielded wire, unshielded wire to the terminal for signal, and open the other ends.
Insulate the opened terminals securely.

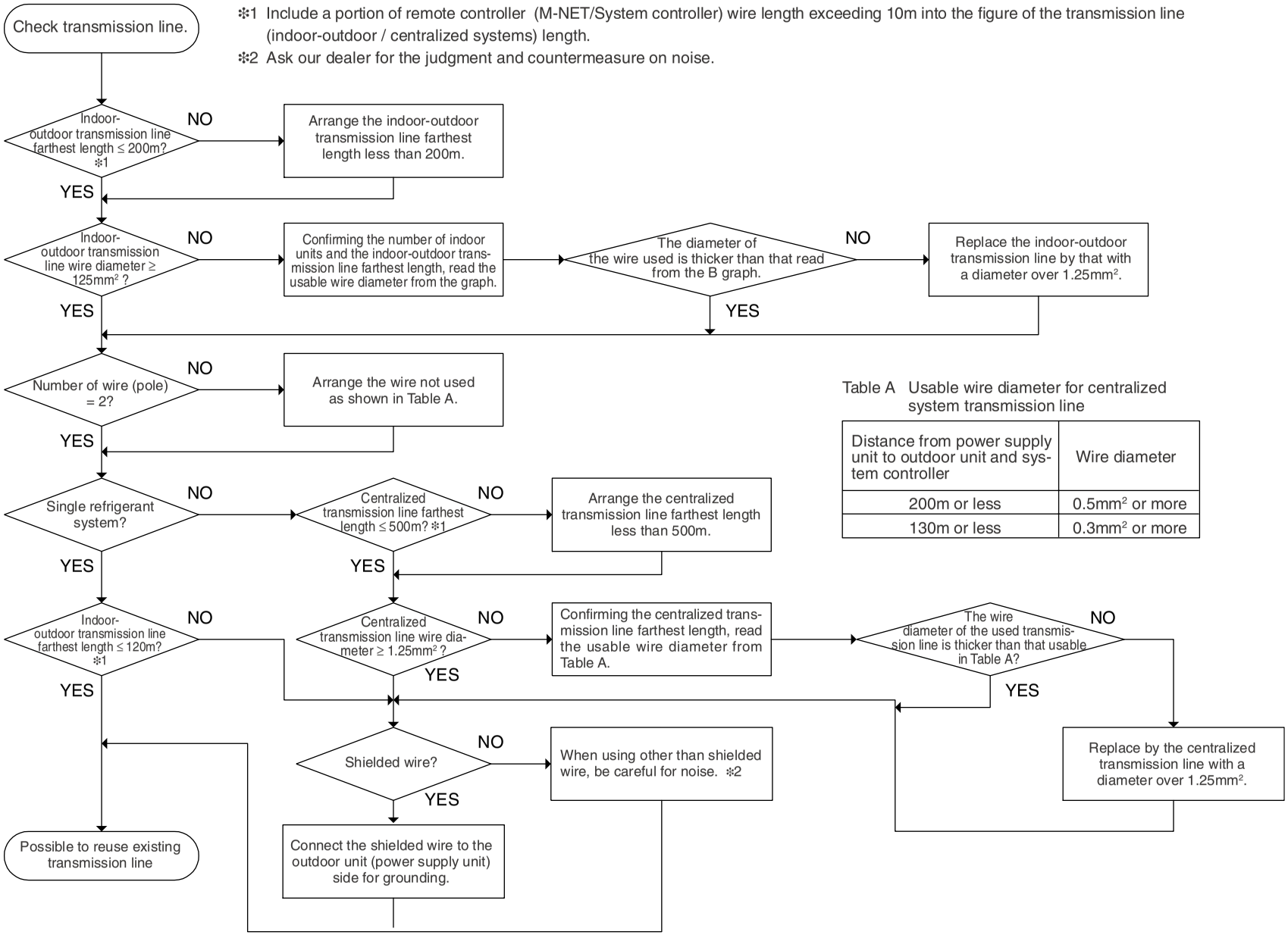
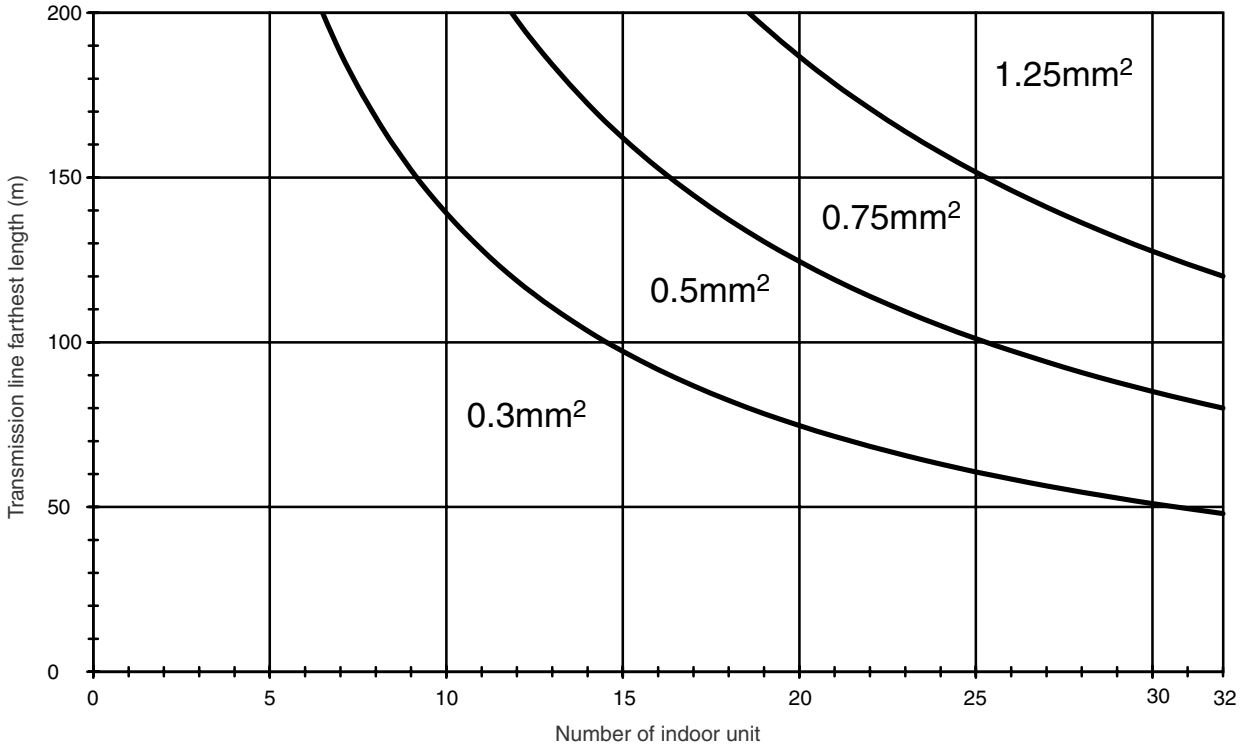

Check transmission line.
❇1 Include a portion of remote controller (M-NET/System controller) wire length exceeding 10m into the figure of the transmission line (indoor-outdoor / centralized systems) length.
❇2 Ask our dealer for the judgment and countermeasure on noise.
Indoor-outdoor transmission line farthest length ≤ 200m? ❇1
NO
Arrange the indoor-outdoor transmission line farthest length less than 200m.
YES
Indoor-outdoor transmission line wire diameter ≥ 125mm² ?
NO
Confirming the number of indoor units and the indoor-outdoor transmission line farthest length, read the usable wire diameter from the graph.
The diameter of the wire used is thicker than that read from the B graph.
NO
Replace the indoor-outdoor transmission line by that with a diameter over 1.25mm².
YES
Number of wire (pole) = 2?
NO
Arrange the wire not used as shown in Table A.
YES
Single refrigerant system?
NO
Centralized transmission line farthest length ≤ 500m? ❇1
NO
Arrange the centralized transmission line farthest length less than 500m.
YES
YES
Indoor-outdoor transmission line farthest length ≤ 120m? ❇1
NO
Centralized transmission line wire diameter ≥ 1.25mm² ?
NO
Confirming the centralized transmission line farthest length, read the usable wire diameter from Table A.
The wire diameter of the used transmission line is thicker than that usable in Table A?
NO
YES
YES
YES
Shielded wire?
NO
When using other than shielded wire, be careful for noise. ❇2
YES
Replace by the centralized transmission line with a diameter over 1.25mm².
Possible to reuse existing transmission line
Connect the shielded wire to the outdoor unit (power supply unit) side for grounding.

Table A Usable wire diameter for centralized system transmission line

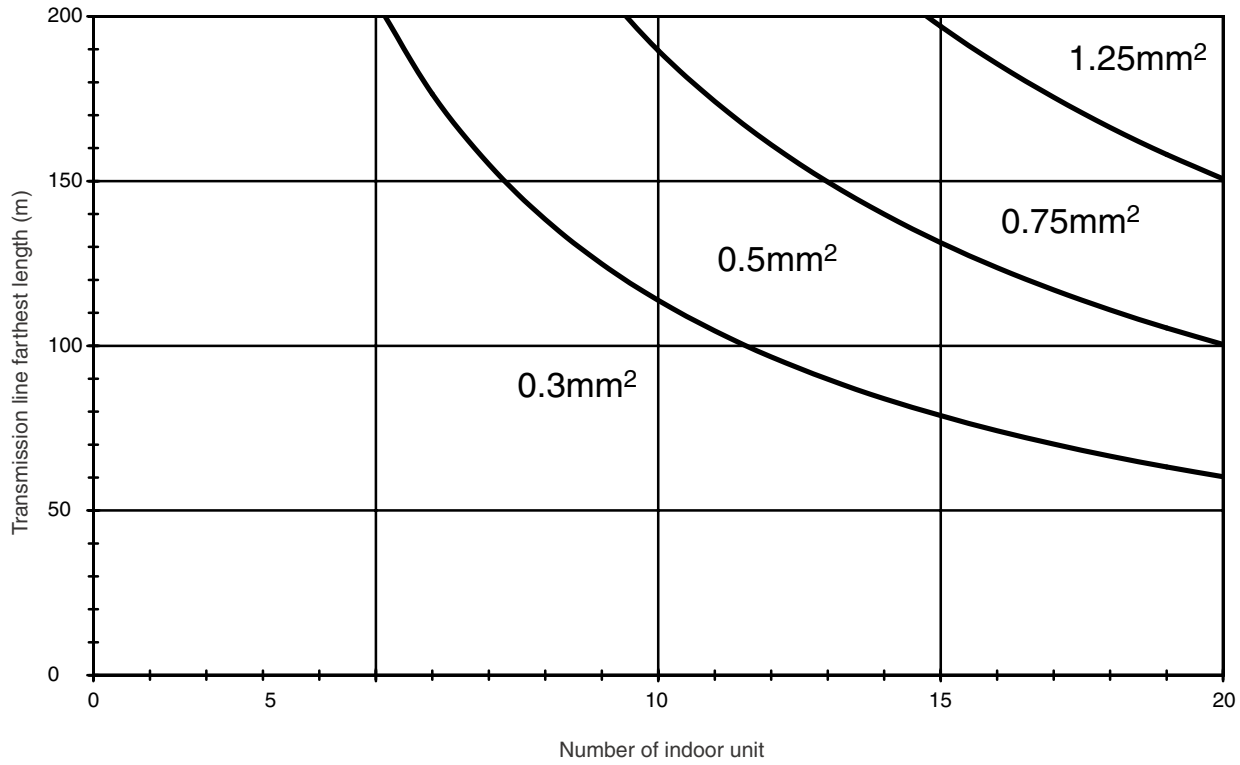
Distance from power supply unit to outdoor unit and system controller	Wire diameter
200m or less	0.5mm² or more
130m or less	0.3mm² or more

Fig. B Usable wire diameter

For connection with MA remote controller



For connection with M-NET remote controller



System Design

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I. Outline of Equipment

1. Combination of units

The connectable units to this product are shown below.

• Cool/heat selection Y System

Outdoor unit model name	Total capacity of connected indoor unit model names	Quantity of connectable indoor unit	Connectable indoor unit model name
PUHY-P200YREM-A	100 ~ 260	1-set ~ 13-set	P20 ~ P250 New refrigerant series indoor unit and ventilation relating equipment
PUHY-P250YREM-A	125 ~ 325	1-set ~ 16-set	

Note: The total capacity of connected indoor unit model name represents the summed up total of the numerical figure portion of the indoor unit model names.

2. Temperature range allowing mineral oil recovery operation

Outdoor inlet dry bulb temperature –5 ~ 43˚C

3. Items to be observed

• Refrigerant flow sound, operating sound of solenoid valve switching

Caution	Countermeasure
During mineral oil recovery, flowing sound may be generated depending on the status of refrigerant. In addition, operating sound may be generated at the switching of the solenoid valve. (These symptoms do not represent abnormal states.)	Install the unit at a place not affected by the sound generated from the unit.

• RE: Effect of noise

Caution	Countermeasure
As the air conditioner uses microcomputer, radiation noise is emitted from the power source, transmission line and unit body slightly. If the unit is installed near equipment that amplify microscopic signals electrically (wireless microphone, medical equipment for example), these equipment may operate erroneously affected by the noise. Further installing the air conditioner near the equipment emitting strong noise (like electric discharge machine etc.) may cause the malfunction of the air conditioner due to the noise. In the case when such troubles are expected, please take the countermeasure shown right.	The equipment which may likely be affected by noise (receiver of wireless microphone or antenna) are recommended to be install isolated from the transmission line, power source line of the unit and the unit body. The power source line of the equipment emitting strong noise and that of the air conditioner should be separated, and the transmission line, power source line and unit body should be installed isolating each other as much as possible.

II. Product Specification

1. Outdoor unit

(1) Specification table

Y Series

Outdoor unit model name				PUHY-P200YREM-A	PUHY-P250YREM-A
Power source				3N~ 380/400/415V 50/60Hz	
Cooling capacity ❇1			kW	22.4	28.0
Heating capacity			kW	25.0	31.5
Electrical characteristic	Power input	Cooling	kW	6.32	8.54
		Heating	kW	6.80	8.95
	Current	Cooling	A	10.6/10.1/9.7	14.4/13.6/13.2
		Heating	A	11.4/10.9/10.5	15.1/14.3/13.8
Refrigerant/Lubricant				R407C/MEL32	
Compressor		Type x quantity		Hermetic x 1	
		Motor output	kW	5.3	6.8
		Starting system		Inverter start	
Crankcase heater			W	45 (240V)	45 (240V)
Fan		Type x Quantity		Propeller fan x 1	
		Airflow rate	m^3/min	200	200
		Motor output	kW	0.38	0.38
Protection devices		High pressure protection		2.94MPa	
		Compressor		Over current protection . over heat protection	
		Fan		Thermal switch	
		Inverter		Over current protection . thermal protection	
Refrigerant piping diameter		Gas pipe	mm	ϕ25.4	ϕ28.58
		Liquid pipe	mm	ϕ12.7	ϕ12.7
Noise level ❇2			dB(A)	56	57
External finish				Pre-coated galvanized sheets (MUNSELL 5Y 8/1 or similar)	
External dimension		High	mm	1755	1755
		Width	mm	990	990
		Depth	mm	840	840
Net weight			kg	239	239
Operating temperature range				Indoor : 15˚CWB~24˚CWB Outdoor : –5˚CDB~43˚CDB (0˚CDB~43˚CDB with out-door unit at lower position)	Indoor : 15˚CDB~27˚CDB Outdoor : –15˚CWB~15.5˚CWB
Matters deserving special mention				A pipe of ϕ28.58 can be used for the gas pipe	

Note : 1. Cooling/heating capacity indicates the maximum value at operation under the following condition.

❇1 **Cooling** Indoor : 27˚CDB/19˚CWB Outdoor : 35˚CDB

Heating Indoor : 20˚CDB Outdoor 7˚CDB/6˚CWB

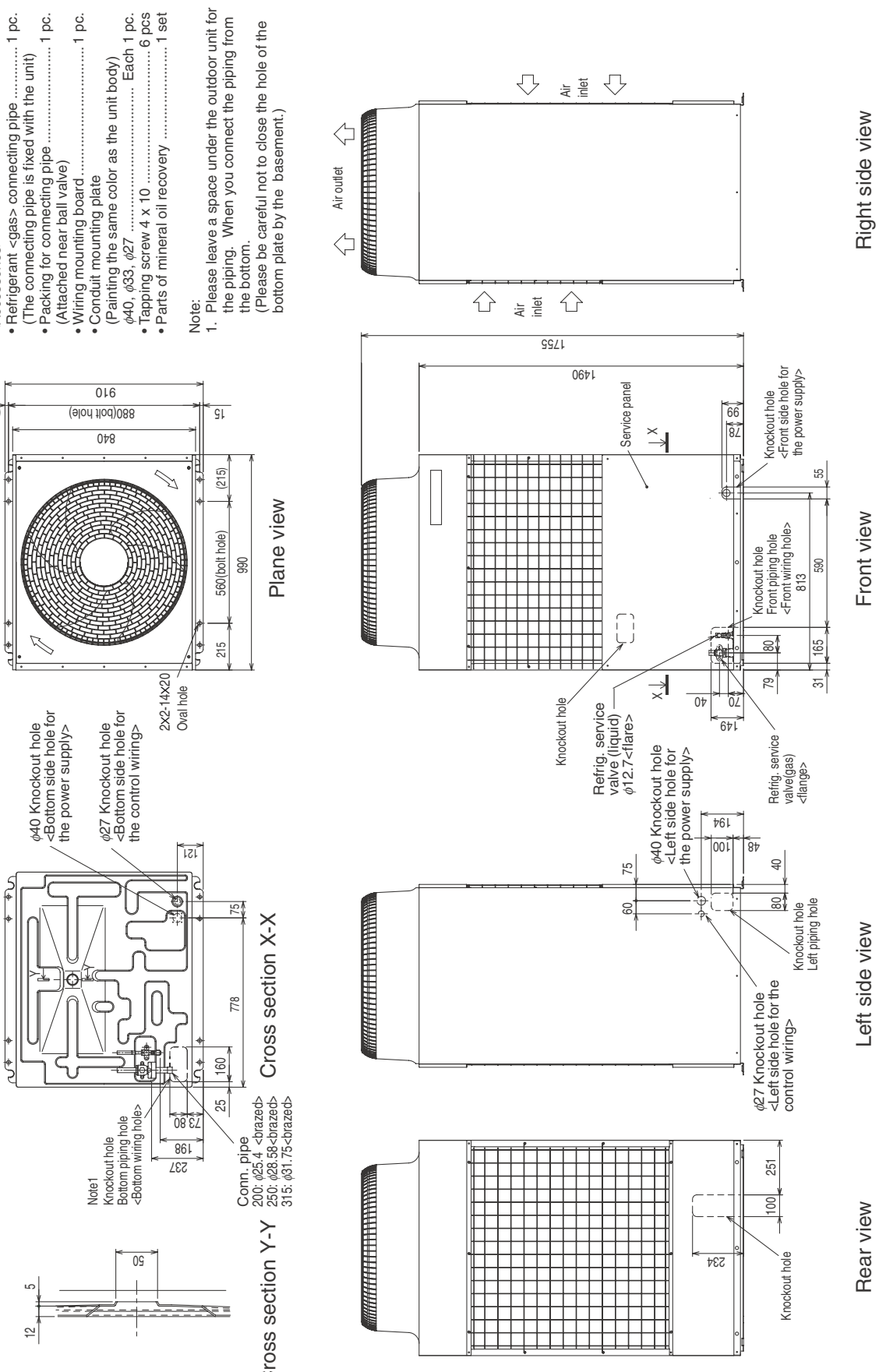
Piping length : 7.5m

❇2 It is measured in anechoic room.

(2) External dimensions

Models PUHY-P200, P250YREM-A

Unit: mm



2. Oil trap kit

(1) Specification table

Oil trap kit model name				PAC-KP90VCLU
Power source				~N 220/230/240V 50Hz
Electrical characteristic	Power consumption		kW	0.049
	Current		A	0.20/0.21/0.22
External finish				Galvanized steel sheets
External dimension	Height		mm	1091
	Width		mm	336
	Depth		mm	757
Refrigerant piping	Ball valve side (at outdoor unit)	High pressure	mm	ϕ12.7 Flare connection
		Low pressure	mm	ϕ28.58 Flange connection
	Fitting side (at extended piping)	High pressure	mm	ϕ15.88 Flare connection
		Low pressure	mm	ϕ19.05 Flare connection
Net weight			kg	76
Accessories				Packing ❇1, Hood for low OA ❇2 Pipe 1,Pipe 2, Saddle, Packing, Screw

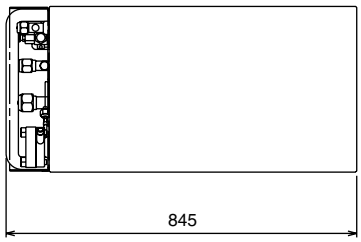
❇1 The packing is provided for 5 pcs. (mineral oil recovery for 1 time). Please purchase additional packing if required. (Service parts code : R61 F14 514, Service model name code : P321009X01)

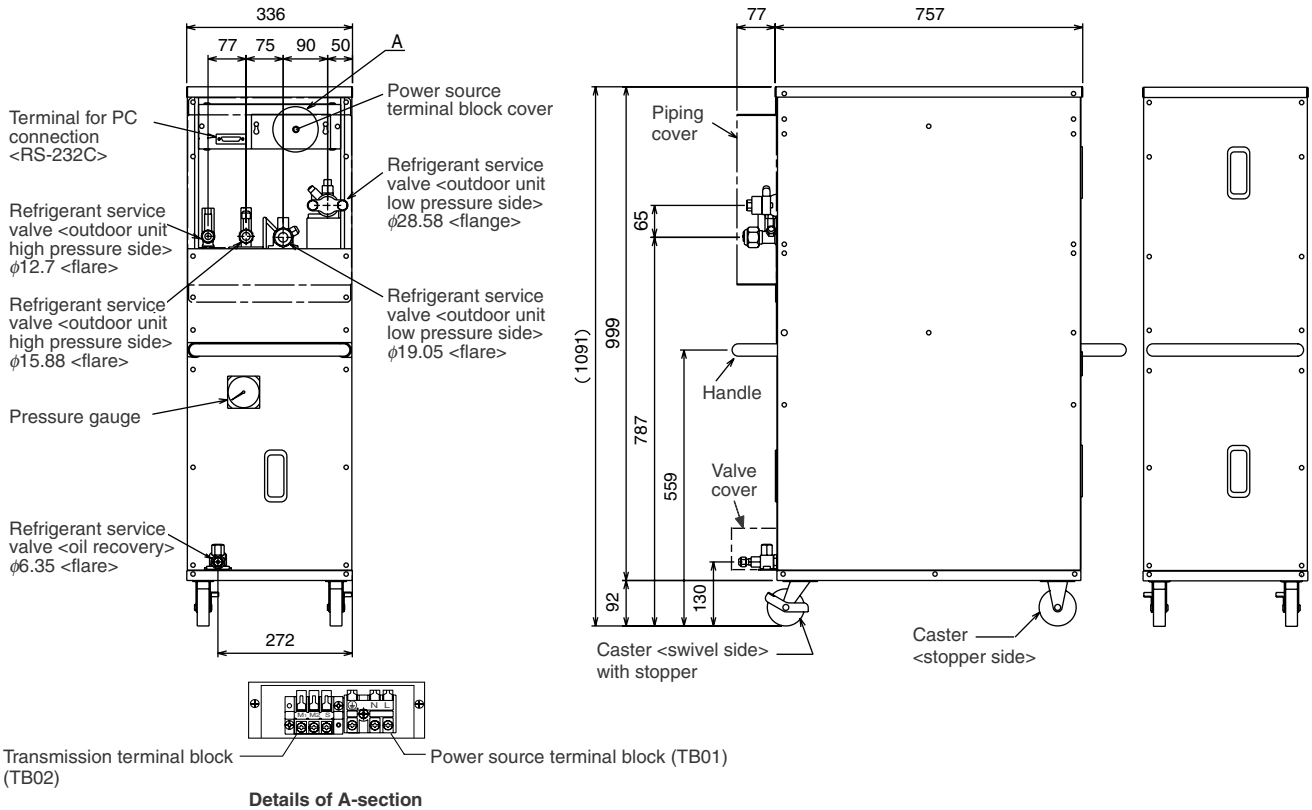
❇2 Service parts code : R61 M03 622, Service model name code : W650296G01

(2) External dimension

Notes: 1. For the connection and operation control of the oil trap kit, you are kindly requested to obtain our approval.

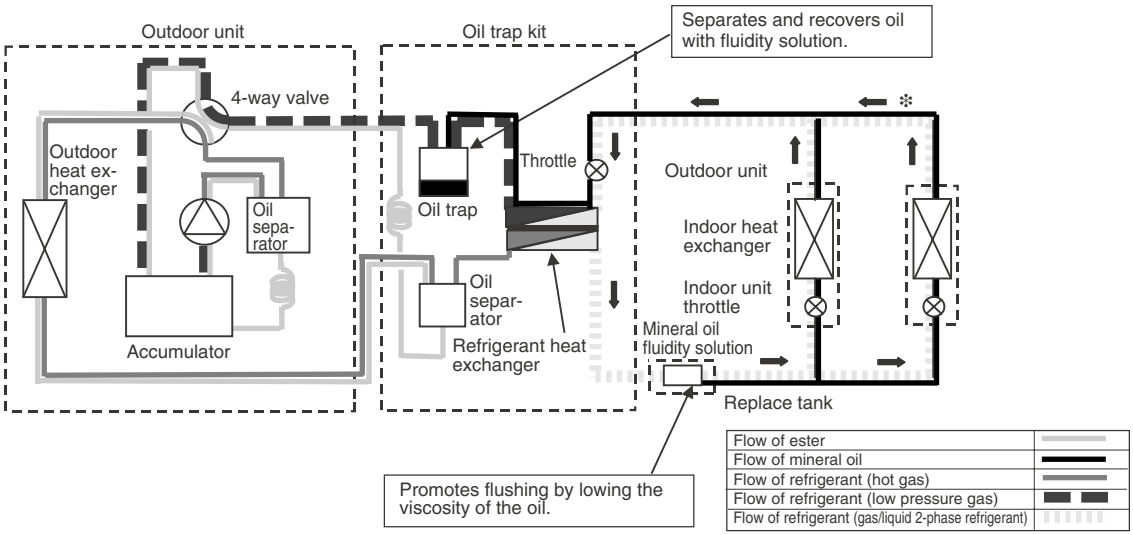
2. Make the piping length between the oil trap kit and the outdoor unit 5m or less. <The optional flexible hose (2m) is prepared by Mitsubishi.>



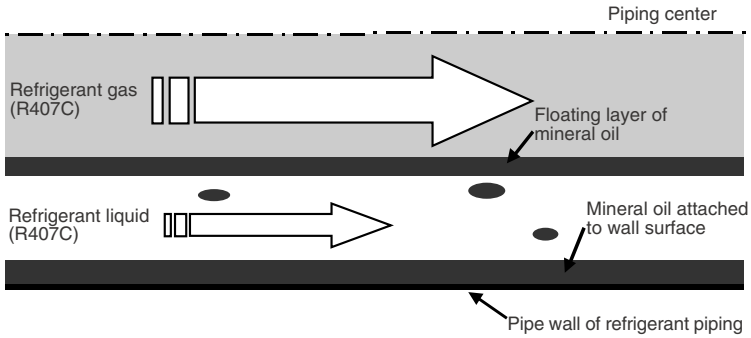


III. Outline of Flushing Operation

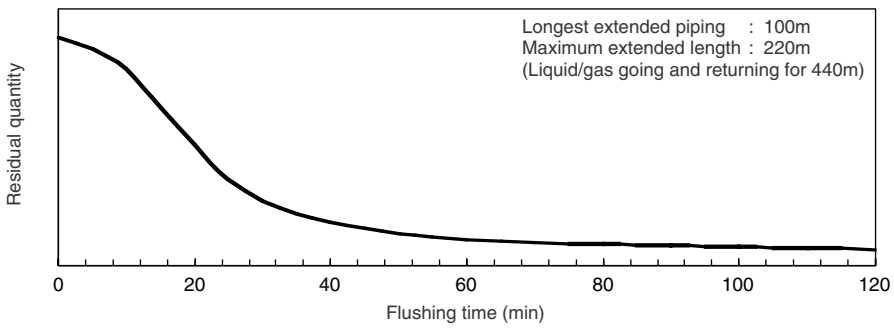
Install the oil trap kit between the outdoor unit and extended piping. Operation of the outdoor unit is in cooling mode, feeding the R407C charged in the system under a gas/liquid two-phase state from the oil trap kit heat exchanger. By feeding the refrigerant in the gas/liquid two-phase state into the existing piping, the residual mineral oil inside the existing extended piping can be recovered into the oil trap kit. Feeding oil fluidity solution from upstream of the existing piping can maintain or even increase the fluidity of residual mineral oil, thus allowing the mineral oil to flow through the indoor units.



Principle of recovery by refrigerant under gas/liquid 2-phase state incompatible with mineral oil (❇ mark portion above)


Piping center
Refrigerant gas (R407C)
Floating layer of mineral oil
Refrigerant liquid (R407C)
Mineral oil attached to wall surface
Pipe wall of refrigerant piping

The mineral oil used as the refrigerating machine oil of conventional refrigerant (R22) systems are oils mostly incompatible with new refrigerant (R407C). By flowing R407C to piping attached with mineral oil, the mineral oil is forced out and peeled off from the pipe wall by the shearing force applied between the mineral oil and refrigerant liquid. Then it is carried out while floating on the surface of refrigerant liquid. If it is under gas/liquid 2-phase state at this moment, the liquid refrigerant will be accelerated by gas refrigerant flowing at high speed in the center of the pipe. Thanks to this accelerated flow, the mineral oil inside piping can be collected quickly.



Residual oil quantity in piping against flushing time

Installation / Operation Work

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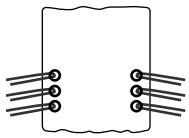
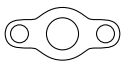
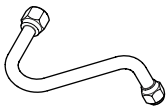
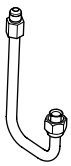
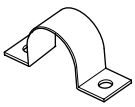
I. Parts Provided with Oil Trap Kit

1. Verifying the parts provided

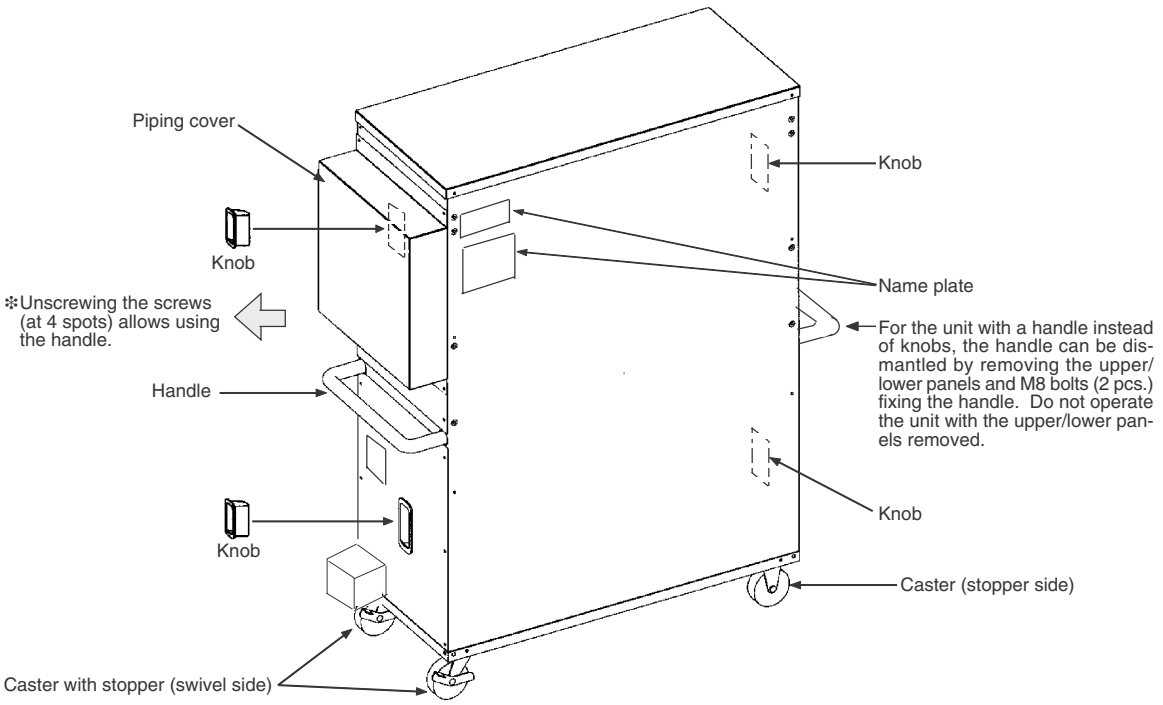
Please confirm that the following parts are provided with this oil trap kit.

Appearance			
Storing position	Provided at the control box bottom	Provided at the control box bottom	
Quantity	1 pc.	5 pcs.	
Appearance			
Storing position	Provided inside piping cover	Provided inside piping cover	
Quantity	1pc.	1pc.	
Appearance			
Storing position	Provided at the control box bottom	Provided at the control box bottom	Provided at the control box bottom
Quantity	1pc.	1pc.	4pcs.

(1) Service parts code : R61 M03 622, Service model name code : W650296G01

(2) The packing is provided for 5 pcs. (mineral oil recovery for 1 time). Please purchase additional packing if required. (Service parts code : R61 F14 514, Service model name code : P321009X01)

II. Carrying/Storing the Oil Trap Kit


Piping cover
Knob
Knob
Name plate
❇Unscrewing the screws (at 4 spots) allows using the handle.
For the unit with a handle instead of knobs, the handle can be dismantled by removing the upper/lower panels and M8 bolts (2 pcs.) fixing the handle. Do not operate the unit with the upper/lower panels removed.
Handle
Knob
Knob
Caster (stopper side)
Caster with stopper (swivel side)

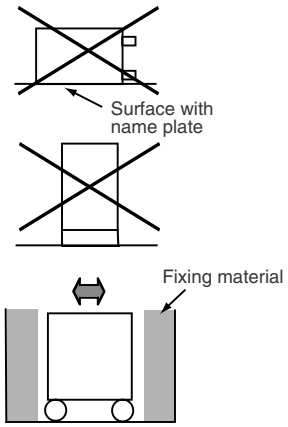
1. Transportation by vehicles

For the transportation by vehicles, ensure that sufficient care has been paid to the withstanding force of the product. However, please observe the items below and pay careful attention to prevent the product from falling down or being damaged.

(1) When carrying the product while being laid down, locate the name plate on the upside.
Do not place any goods on the sheet metal surface.
Reason : The letters on the name plate can not be read. The inner piping may be deformed leading to damage.

(2) Do not locate the piping cover downward.
Reason : The service valve is damaged causing possible gas leak.

(3) Carrying the product while locating the caster downward causes unstable condition leading to falling down due to the vibration during transportation. Provide a measure to prevent falling down.



2. Carrying-in / carrying-out

The product is mounted with the parts for transportation, including one handle, knobs (at 5 places) and casters (at swivel side and stopper side). For the carrying-in and -out of the product, locate it horizontally (with the name plate at the upper side) or vertically and pay careful attention to prevent it from falling or dropping due to obstacles. Refrain from locating the piping cover facing downward. (If dropped, the service valve may be damaged.)

3. Storing

When storing the product, observe the items below.

(1) Store in a cool and dark place avoiding direct exposure to solar radiation. (Storing temperature less than 60˚C)

(2) Store the oil trap kit fixed with the stopper locating the caster in the downward facing position.

(3) Store the oil trap kit, flexible tube and branch piping kit mounted with the cap previously provided. (to prevent the entry of dirt, dust and water)

(4) Store the oil trap kit, flexible tube with their original packing.
Do not lose the packing materials as they are to be used for storing.
Oil trap kit : Applied corrugated cardboard to upper part, wooden frames to lower part and fixed with PP band.
Flexible tube : Packed with corrugated cardboard

III. Work Procedure of Mineral Oil Recovery Operation

1. Work flow

For P200·P250YREM-A

Work flow	Items to be verified
Carry in the oil trap kit (1 set), replace tank, PC and tools.	Check the necessary parts (P20) & check the work preparation (P21).
Install the oil trap kit, replace tank and PC. Perform air tightness test Evacuate the piping (Flexible tube)	1. Turn the outdoor unit power source off. 2. Mount the replace tank to the oil trap kit.. 3. Connect the outdoor unit, valve mounted to the extended piping and oil trap kit with piping (flexible tube). 4. Conduct airtight test and evacuation the piping (flexible tube) between the outdoor unit, valve mounted to the extended piping and oil trap kit. 5. Open the ball valve. (in the order of oil trap kit (1)~(4), extended piping, outdoor unit (1) and (4).) 6. For the oil trap kit, apply from L1 and N of outdoor unit supply or a separate 220~240V supply power source of the outdoor unit and the transmission line from the outdoor unit TB3. 7. Connect the oil trap kit and PC. 8. The system controller and MA remote controller may be required to be remove. For detail, refer to 1~5 : Piping connection, 6·7 Piping connection. ❇ When conducting mineral recovery work the next day, close all service valves of the outdoor unit, valve mounted to the extended piping and oil trap kit to finish the work, and open all service valves immediately before starting flushing operation. (Otherwise mineral recovery time is extended due to prolonged start-up time, or the oil traped inside the kit is overflown hindering the normal mineral oil recovery.)
Apply flushing inside of the exiting piping. Recover mineral oil inside the oil trap kit.	1. Apply power source to the outdoor unit, and confirm the completion of the start-up. 2. Check the operating sound caused by the ON/OFF of the solenoid valves. 3. Through the PC operation, drive the outdoor unit compressor to recover mineral oil inside the extended piping. The recovery time requires for 1.5 ~ 3 hours. (Outdoor temperature below 20˚C, the low outdoor air hood should be fitted to the outdoor unit.) However under low outdoor temperature, flushing operation may be required again due to insufficient refrigerant. ❇ When the frequency or low pressure drops less than the rated value due to insufficient refrigerant and the such like, the time required for the mineral oil recovery may exceed 3 hours. For detail, refer to P36. 4. Prevent the outdoor unit and oil trap kit from being exposed to rain directly. 5. Close the service valves of the outdoor unit and the valve mounted to the extended piping (4 positions). 6. Close the service valves of the oil trap kit (at 4 spots). 7. Turn off the power source of the outdoor unit once. 8. After flushing operation, recover mineral oil by opening the oil recovery service valve. ❇ The mineral oil recovered by flushing operation should be extracted each time from the oil trap kit. During the work, observe that the pressure is staying within 0.049 ~ 0.294MPa.
Remove the oil trap kit. Connect the piping kit processed there, and evacuate inside of the piping kit.	1. Remove piping (flexible tube) and wiring between the outdoor unit, remove valves mounted to the extended piping and oil trap kit. 2. Remove the oil trap kit. 3. After reconnecting the piping kit (field work) to the outdoor unit, execute evacuation. 4. Open the ball valve (in the order of extended piping, outdoor unit (1) and (4).) 5. Mount the system controllers and MA remote controller previously removed. ❇ After removing the oil trap kit, confirm the inner pressure with a pressure gauge. ❇ Do not store the oil trap kit at a place exposed directly to solar radiation, but store in a cool and dark place.
Confirm operation (compressor starting).	After recovering oil, conduct ordinary air conditioning operation, and check the cooled air (heated air) and the operating condition of the compressor. ❇ **The test run and adjustment work are not included. Execute them separately if required.**
Execute test run & adjustment.	**This belongs to the field work category. Execute it after flushing.**
Inspect oil one month after operation.	1. For the inspection of oil, use suitable kit for the refrigerating machine oil used by the existing unit. (Mineral oil : Ester collection kit) 2. When the recovery of mineral oil is insufficient, ester oil, etc. should be added. ❇ Note: Only in rare cases.

Mineral Oil Recovery Operation

Parts List

	Parts name	Application	Specification (quantity)	Remarks
(1)	Oil trap kit (PAC-KP90VCLU)	Mineral oil recovery device	Built-in solenoid valve, pressure sensor, pressure gauge, service valve	1 set
(2)	Flexible tube (PAC-KP80FPP, PAC-KP-82FPP, PAC-KP83FPP)	Piping connection between oil trap kit and outdoor unit and the valve mounted to the extended piping	ϕ12.7 (2 pcs.), each 1 pc. of ϕ19.05 and ϕ28.58 (ϕ19.05 is for short copper pipe [requires ϕ28.58 –ϕ19.05 connection])	1 set
(3)	Packing	Connection between (2) flange and outdoor unit	5 pcs. (outdoor unit 2 pcs. valve mounted to the extended piping 2 pcs., oil trap kit 1 pc.) [provided inside oil trap kit]	
(4)	PC (Field supply)	Mineral oil recovery operation control	Equipment: DOS-V machine (suitable for PC-98NX or later) CD ROM equipped CPU : 300MHz or larger (recommended) Memory : 64Mbyte or larger (recommended) HDD : 40Mbyte or larger (recommended) O/S : Windows95, 98, NT 4.0, 2000, ME, XP	
(5)	Software	Mineral oil recovery operation software	Exclusive S/W for Replace (Caution : Install on PC before mineral oil recovery.)	
(6)	Connecting cable (field supply)	RS-232C connection of oil trap kit and PC	RS-232C cross cable (within 15m) Oil trap kit connector specification : D-SUB25 Pin type female connector (DTE) (Caution: Select RS-232 cable depending on the type of the serial interface of PC.)	
(7)	Power source wiring (field supply)	Connection to oil trap kit (Jumper from outdoor unit)	ϕ1.5mm^2 or more Power supply cord parts of appliances for heat source shall not be lighter than polychloroprene sheathed flexible cord (design 245IEC57)	
(8)	Control wiring (field supply)		ϕ1.25mm^2 or more 2-core cable (VCTF, VCTEK, CVV, CVS, VVR, VVF, VCT or shielded wire CVVS/CPEVS)	
(9)	Oil pan (field supply)	Mineral oil recovery vessel	Vessel with more than 2L capacity is required.	
(10)	Refrigerant piping, Wiring system diagram	Verification of connection with system controller, others	Refrigerant piping/wiring system diagrams are required for each system	
(11)	Ester oil check kit (PAC-KP95ECK) (Use when the refrigerating machine oil used by conventional system is the mineral oil.)	To judge proper oil recovery at oil inspection about one month after flushing operation executed	Vessel (1 pc.), bottles (2 pcs. 1 pc. with oil charged)	1 set for 1 outdoor unit
(12)	Replace tank (PAC-KP01RTK)	To lower the viscosity of residual mineral oil	Mineral oil fluidity solution	

2. Items to be checked before work

		Check method	Content of checking	Countermeasure
(1)	Confirming the powering of outdoor unit	1) LED display inside outdoor unit control box 2) Confirming the powering time	1) Check whether outdoor unit is being powered. 2) Check the insulation resistance between power source terminal and ground for over 1.0MΩ.	1) Power the outdoor unit for over 12 hours. 2) Power until the insulation resistance between the power source terminal block and ground reaches 1.0MΩ or more.
(2)	Confirming the closed ball valve of outdoor unit, oil trap kit, and the valve mounted to the extended piping	1) Confirming the closed ball valve of outdoor unit and the valve mounted to the extended piping 2) Confirming the closed ball valve of oil trap kit	1) Confirm the ball valve of outdoor unit is fully closed. 2) Confirm the ball valve of oil trap kit is fully closed.	1) Full opening of ball valve • Check the valve operation by field piping work. • Refrigerant charge after flushing operation. 2) Full closing of ball valve • Confirmation of residual pressure inside oil trap kit (by using a pressure gauge) →At no residual pressure, evacuate after confirming airtightness inside oil trap kit and charge refrigerant by 0.5kg.
(3)	Confirming the connection of the system controller to transmission terminal block Confirming MA remote controller	1) Confirming by observing refrigerant system diagram 2) Confirming the field connection	1) Check whether system controller is connected to indoor/outdoor transmission line. 2) The system controller that turns the power source off when turning the outdoor unit power source off is connected to the indoor system. (Power supply from outdoor unit) 3) Check MA remote controller for grouping with different refrigerant circuits.	1) 2) 3) Remove the system controller connected to the indoor/outdoor transmission line and MA remote controller grouped with different refrigerants. Reconnect them after flushing operation. (Only required when indoor unit under Ver30 or LOSSNAY with heating humidifier under Ver8.08 is existing. : Removal is indicated on the PC screen.)
(4)	Confirming the inner pressure of oil trap kit	1) Confirming with pressure gauge	1) Check whether the reading of pressure gauge inside oil trap kit is lower than 0.049 ~ 0.294MPa.	Refer to the countermeasure by confirming the oil trap kit inner pressure shown on the next page.
(5)	Confirming the oil recovery of oil trap kit	1) Confirming the operation of oil recovery service valve	1) Open the oil recovery service valve and check whether the liquid (recovered oil) flows out continually under liquid state.	1) Recover liquid (recovered oil) with an oil pan and the like.

Countermeasure by Confirming Inner Pressure of Oil Trap Kit

(1) In the case of 0.049MPa or less

A leak exists, it must be located and repaired. After repairing the leakage inside the oil trap kit, confirm successful airtightness test and evacuation. After evacuation, charge refrigerant 0.5kg.

(2) In the case of 0.294MPa or more

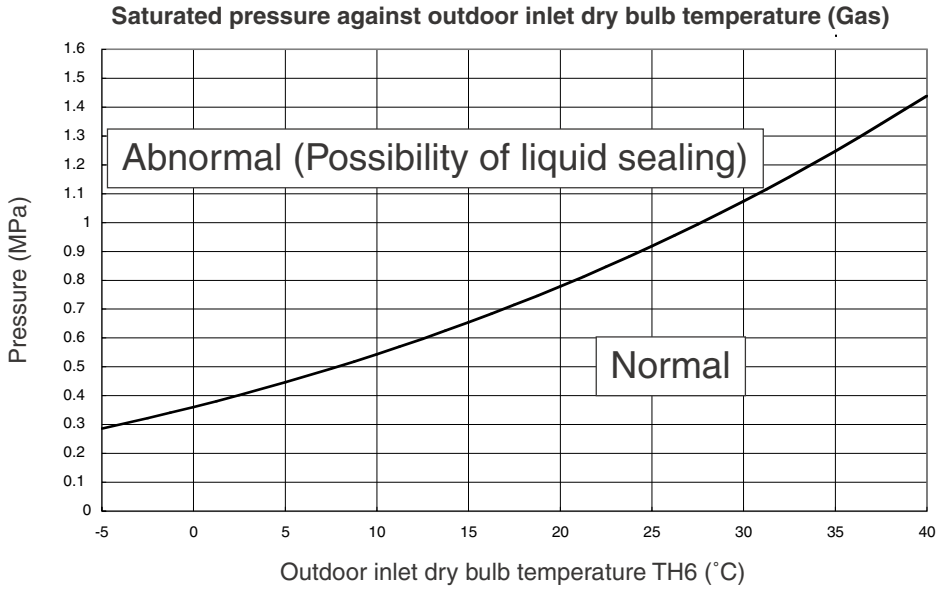
Confirm the outdoor temperature sensor (TH6) of the outdoor unit.
Reference to chart below.

1) Located at lower right side of line

Although this does not indicate abnormality, but causes increase in the inner pressure during storage leading to possible danger. Recover refrigerant to lower the pressure until it reaches less than 0.294MPa. For the method of refrigerant recovery, refer to [IX. 2. 2-3 Refrigerant recovery method].

2) Located at upper left side of line

This indicates the existence of liquid refrigerant. Liquid seal may be formed at storage. Recover refrigerant to lower the pressure until it reaches less than 0.294MPa same as above. For the method of refrigerant recovery, refer to [IX. 2. 2-3 Refrigerant recovery method]. At recovery, measure the recovered quantity. If it exceeds 0.5kg, charge the excess quantity additionally when confirming operation. In addition, check the operation of the solenoid valves. If they are faulty, replace the solenoid valves, confirm airtightness and execute evacuation. After evacuation, charge refrigerant 0.5kg.



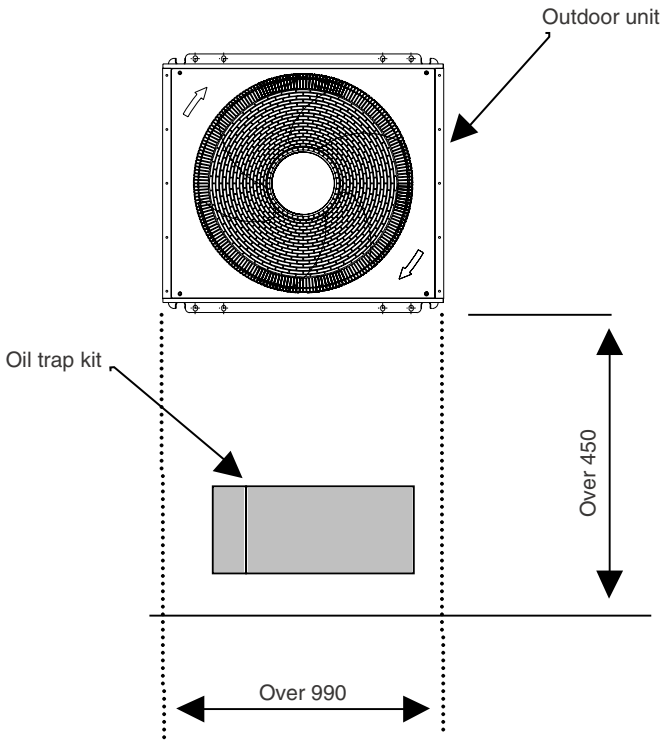
3. Installation space and range of oil trap kit

The installation space required for the oil trap kit and for the piping network is as follows. The installation can be performed by using the front service space of the outdoor unit.
In the case when the installation space of the oil trap kit can not be secured (due to obstacles), install it within the following restrictions on piping length. Arrange the installation so that the unit front is not exposed to seasonal winds (gusts).

(1) Restrictions

Item		Allowable length	Remarks
Piping length		5m or less	The piping length added with piping length and height difference should be less than 5m.
Height difference	Outdoor unit upper	5m or less	
	Outdoor unit lower	5m or less	

In the case of P200 • 250YREM-A



⚠ Caution

When installing the oil trap kit on a slanted ground or at a place directly exposed to the seasonal wind (gust), ensure it will not be blown over.

- If the oil trap kit does fall over it will damage the solenoid valves disabling the ability to perform flushing operation. Refrigerant leak and personal injury may also occur.

4. Refrigerant piping work

4-1 Piping connection before flushing operation

(1) Piping connection to outdoor unit

Connect the outdoor unit and oil trap kit, pipe and wire by following the procedure.

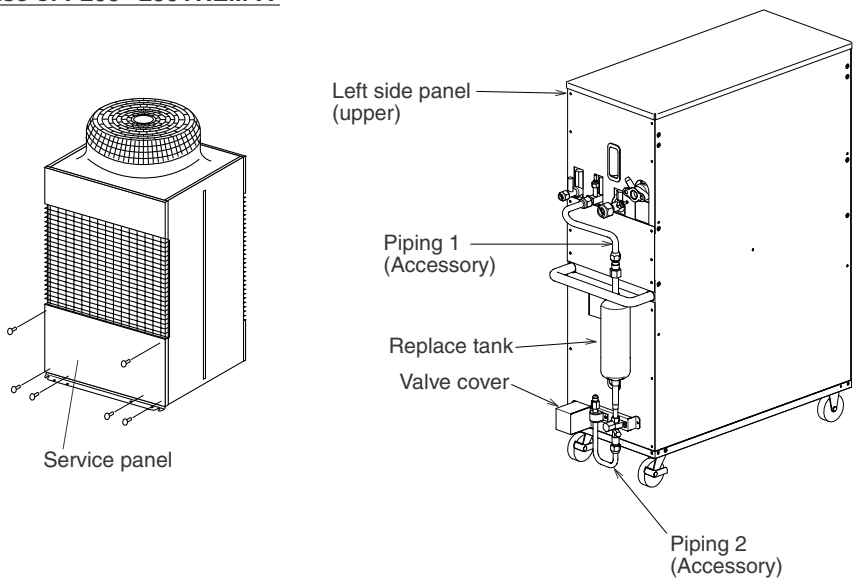
(1) Turn off the main power source of the outdoor unit.

(2) Remove the service panel from the outdoor unit and oil trap kit, piping cover and the side panel (6 screws in total).

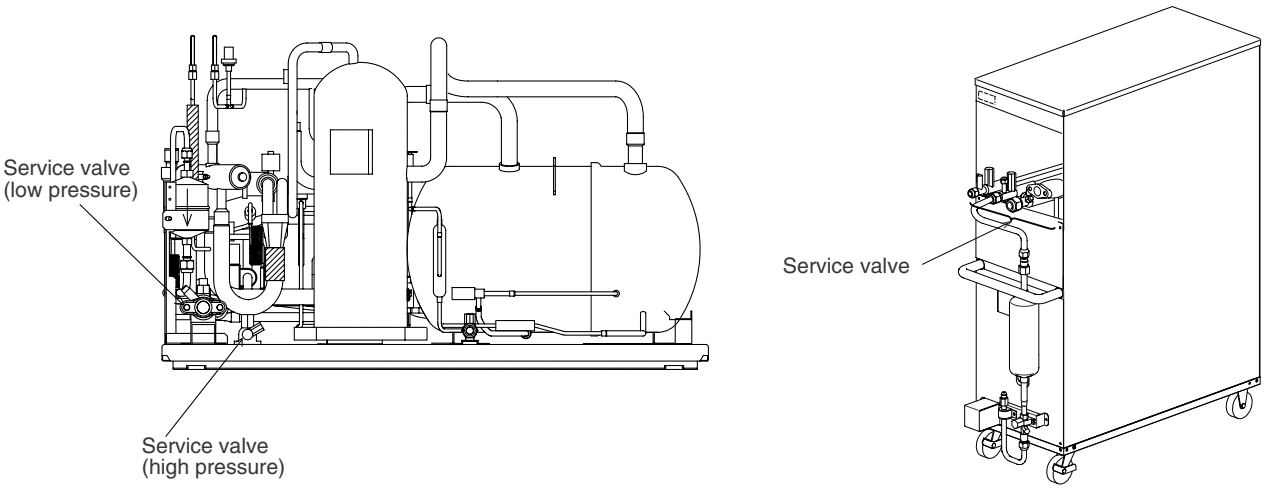
(3) Confirming the service valves of the outdoor unit, valves mounted to the extended piping and oil trap kit are closed, and remove a piping cover. Mount the replace tank to the oil trap kit. (Use the Piping 1 and 2 provided to the oil trap kit to mount the replace tank.)

❇ Do not lose the Piping 1 and 2 of the oil trap kit, as it can be reused. When using the copper pipe for general refrigerant piping, connection can be performed without using Piping 2 by using the valve of the replace tank.

In the case of P200 • 250YREM-A



In the case of P200 • 250YREM-A



(4) Connect the flexible tube to the outdoor unit, valve mounted to the extended piping and oil trap kit (1) ~ (4).

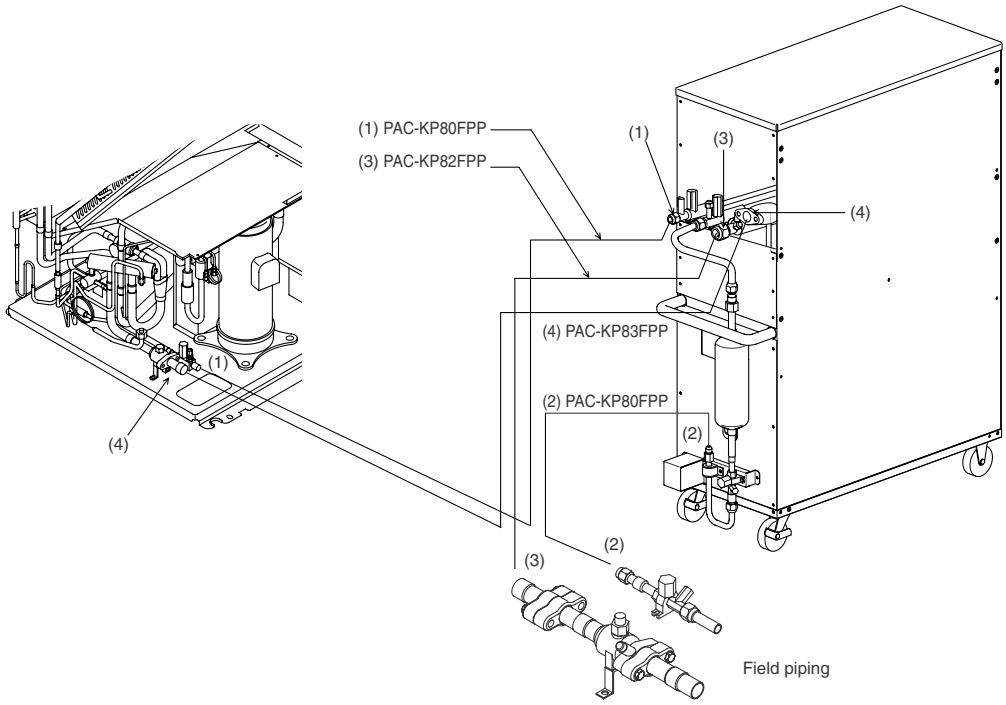
When general refrigerant piping copper pipe is used, select a suitable type by referring to the piping specification of flexible tube shown below. When the length of piping connected to the outdoor unit and oil trap kit exceeds 2m, use the general refrigerant piping copper pipe with the selected diameter for a portion of over 2m by referring to the following table.

	Piping dia. (mm)	Pipe thickness (mm)	Piping length	Remarks
(1)	ϕ12.7	0.9	2m	
(2)	ϕ12.7	0.9	2m	
(3)	ϕ19.05	1.0	2m	Requires to mount short copper pipe (ϕ28.58–ϕ19.05)
(4)	ϕ28.58	1.2	2m	Requires to mount flange ✻1

Caution : Mount the connecting pipe (1) ~ (4) correctly without erroneous connection.
Erroneous connection does not allow recovery of mineral oil.

✻1 Service parts code R61 E91 494

In the case of P200 • 250YREM-A



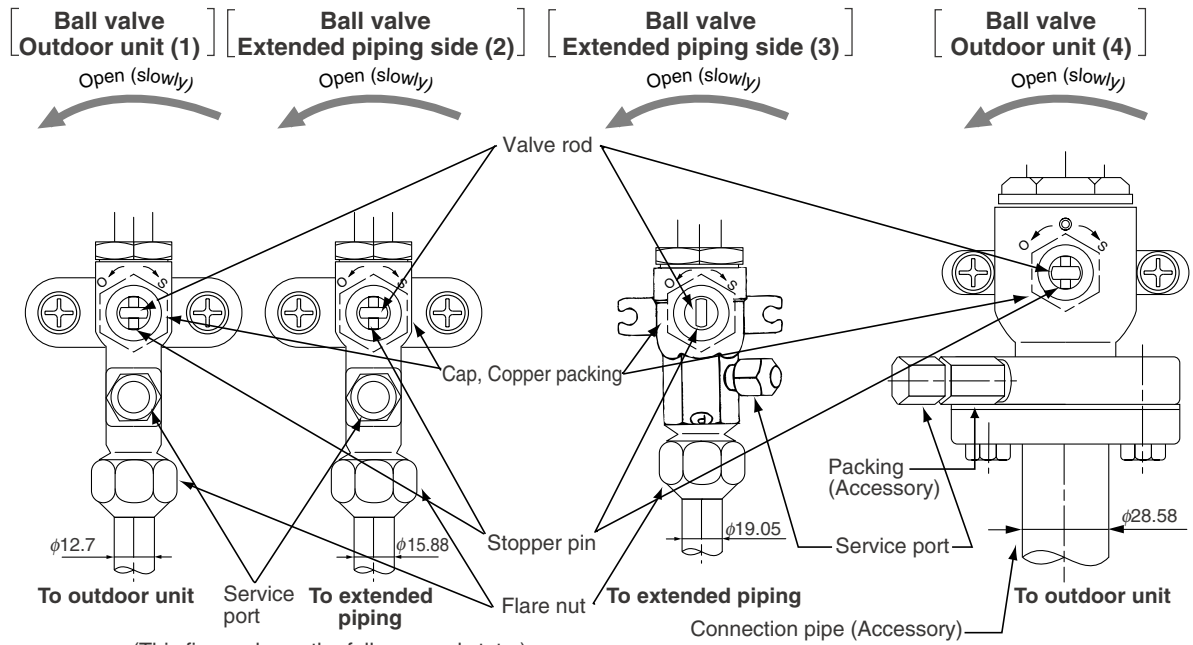
Connection method:

Remove short copper pipe and flare nut, select the flexible piping corresponding to the number in the drawing shown above from the following table, and connect to the port with same number.

No.	Type	Connection configuration	Quantity
			P200, 250YREM-A
(1)	PAC-KP80FPP	ϕ12.7 flare conn. – ϕ12.7 flare conn.	1
(2)	PAC-KP80FPP	ϕ12.7 flare conn. – ϕ12.7 flare conn.	1
(3)	PAC-KP82FPP	Flange joint – ϕ19.05 flare conn.	1
(4)	PAC-KP83FPP	Flange joint – Flange joint	1

(2) Valve operation

- For piping connection and valve operation, follow the figure below. (The figure below shows the ball valve of the oil trap kit.)
- For the flange section of the piping (flexible tube), use new packing (provided only for 1 time use) and mount firmly to avoid gas leak. Coat refrigerating machine oil (ester oil, ether oil or alkyl benzene (a little amount)) on both sides of the packing.
- For opening/closing of flare nuts, use two spanners together. Coat refrigerating machine oil (ester oil, ether oil or alkyl benzene (a little amount)) on the flare contacting surface.
- **After evacuation, make sure to fully open the handle.** Operating with a valve closed generates abnormal pressure inside the refrigerant circuit, possibly damaging the compressor, 4-way valve etc. After completing work, **tighten the service port and cap firmly**, so as not to generate a gas leak.



(This figure shows the fully opened state.)

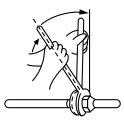
Part name	Detail
Valve rod	Fully close at shipment, piping work, air tightening and evacuating work. Fully open after completing the above works.
Cap, Copper packing	Remove the cap and operate the rod valve. Mount it at its original position after finishing work. (Clamping torque of valve rod cap : 25N•m or more)
Stopper pin	The valve rod does not rotate over 90˚.
Service port	Use for the airtightness and evacuation inside existing piping in the field. Use two spanners to open/close. (Clamping torque : 14N•m or more)
Flare nut	Use two spanners to open/close with a clamping torque of 80N•m. Coat refrigerating machine oil (ester oil, ether oil or alkyl benzene (a little amount)) on the flare contacting surface.
Connection pipe (Accessory)	Mount the packing (accessory) firmly to the valve flange to avoid gas leak. (Clamping torque : 23N•m or more) Coat refrigerating machine oil (ester oil, ether oil or alkyl benzene (a little amount)) on the flare contacting surface.

Proper clamping torque by torque wrench

Copper pipe OD (mm)	Clamping torque (N•m)
ϕ6.35	14 ~ 18
ϕ9.52	35 ~ 42
ϕ12.7	50 ~ 57.5
ϕ15.88	75 ~ 80
ϕ19.05	100 ~ 140

Standard of clamping angle

Pipe dia.	Clamping angle
ϕ6.35 ϕ9.52	60˚ ~ 90˚
ϕ12.7 ϕ15.88	30˚ ~ 60˚
ϕ19.05	20˚ ~ 35˚



✻When a torque wrench is not available, use the method below instead.
When tightening the flare nut with a spanner, the clamping torque may abruptly increases.
Stop the tightening once at this moment, and rotate further for the angle shown in the above table.

⚠ Caution

Make sure to remove the connection pipe from the ball valve, and braze it outside the unit.

- Brazing it while mounted heats the ball valve which may cause machine trouble or gas leak. Also the wiring inside the unit may be burnt.

⚠ Caution

For the refrigerating machine oil to coat on the flare/flange connections, use ester oil, ether oil or alkylbenzene (a little amount).

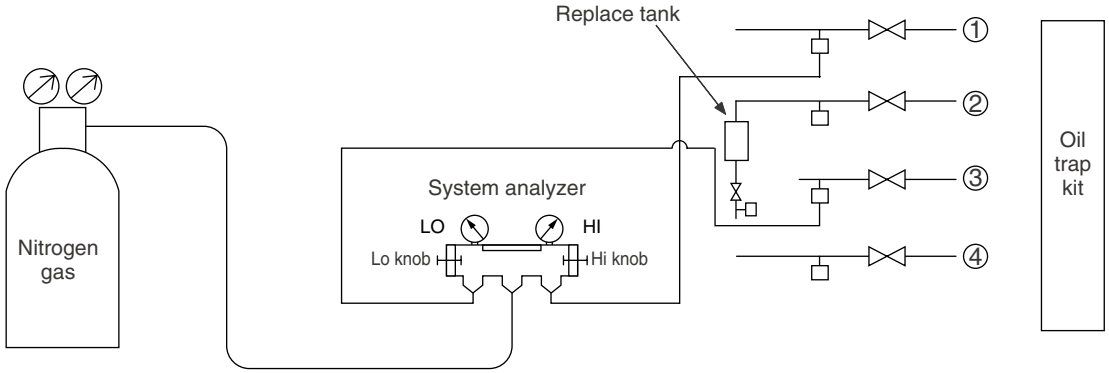
- Mixing of mineral oil in a large quantity may cause a deterioration of refrigerating machine oil.

(3) Airtightness and evacuation of flexible tube

(1) Airtight test

For the airtight test, pressurize the flexible tube from the service port on the end of it (at the oil trap kit side) while closing the refrigerant service valve (ball valve) of the oil trap kit, valve mounted to the extended piping and outdoor unit while opening the valve of the replace tank. After applying to ① and ③, apply to ② and ④. (The figure below shows the state of ① and ③.)

Make sure to pressurize all flexible tubes. (4 spots)



As the procedure of the airtight test gives the serious effect in deteriorating refrigerating machine oil, make sure to observe the items of restriction.

In addition, as the composition of the non-azeotropic mixture of refrigerants R407C will change if there is a gas leak, therefore affecting the performance, so conduct the airtight test very carefully!

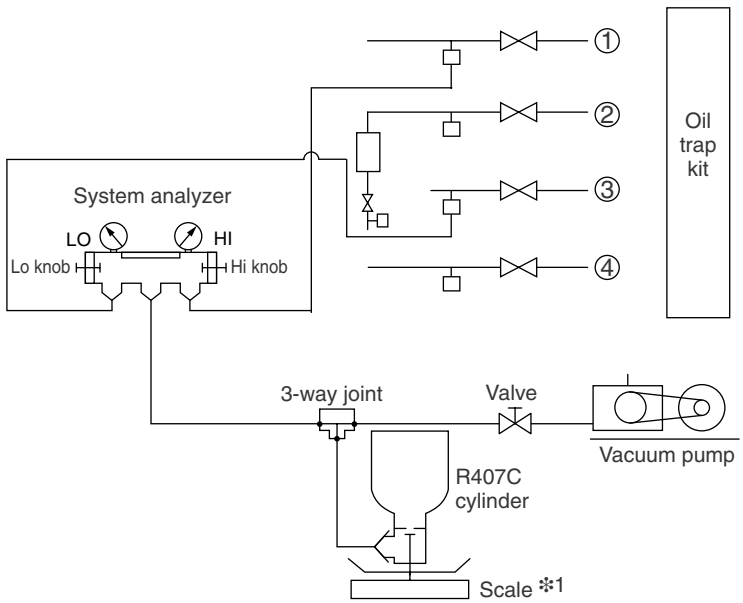
Procedure of airtight test	Restriction
1. For pressurizing with nitrogen gas (1) After pressurizing to the design pressure [①, ② : 2.98 MPa, ③, ④ : 1.56MPa] with nitrogen gas, leave it for about 15 minutes. It is acceptable if no pressure drop is found. When the pressure drops, a test can be conducted using the foam method below to find the leaking spot. (2) After pressurizing as above, spraying foaming agent (Cuboflex) onto the spots where leaking is expected, such as the flare connections, brazed connections and flange connections, etc., and observe the generation of foaming visually. (3) Wipe off the foaming agent after finishing the airtight test.	x Using combustible gas or air (oxygen) for the pressurizing gas can cause an explosion.
2. For pressurizing with refrigerant gas and nitrogen gas (1) Charge R407C under liquid state from the cylinder, and pressurize it to about 0.2MPa by gas pressure. Then pressurize with nitrogen gas up to the design pressure [①, ② : 2.98MPa, ③, ④ : 1.56MPa]. Avoid to continuous pressurization, pause during the process to confirm no pressure drop is found. (2) By using an electric leak detector for R407C, check gas leak at all spots likely to generate gas leak, such as the flare connections, brazed connections and flange connections. (3) This may be used together with the foaming test.	x Refrigerants not indicated on the equipment can not be used. x Charging from the cylinder under gas state changes the composition of refrigerant inside the cylinder. x Use parts like pressure gauge, charging hose, etc. exclusive for R407C. x The electric leak detector for R22 can not detect R407C. x The color rendering type (halide torch) can not be used. (unable to detect)

(2) Evacuation

For the evacuation of the flexible tube, evacuate the flexible tube from the service port on the end of it (at the oil trap kit side) while closing the refrigerant service valve (ball valve) of the oil trap kit, valve mounted to the extended piping and outdoor unit while opening the valve of the replace tank. After applying to ① and ③, apply to ② and ④. [The figure below shows the state of ① and ③.] Make sure to evacuate all flexible tubes. (4 tubes)

After reaching the degree of vacuum at 650Pa [abs], evacuate further for 3 minutes or more. Then stop the vacuum pump and leave it for 3 minutes. Confirm that the degree of vacuum does not rise at this moment. (When the degree of vacuum increases by more than 130Pa, moisture has possibly been mixed. Pressurize dry nitrogen gas up to 0.05MPa, and evacuate again.) **Last, open the ball valve of the oil trap kit and then those of the outdoor unit in that order.** (The reverse order if applied may damage the compressor.)

❇ Never attempt to purge air by using refrigerant.



⚠ Caution

Use a vacuum pump with reverse flow protector.

- Otherwise, the vacuum pump oil flows in reverse direction into the refrigerant circuit which may cause deterioration of the refrigerating machine oil of the equipment.

❇1. Use a scale with high accuracy (measurable up to 0.1kg).

❇2. Use a vacuum gauge equipped with reverse flow protector.
(Recommended vacuum gauge : ROBINAIR 14010 Thermistor Vacuum Gauge)
Employ a vacuum pump that indicates 65Pa [abs] or less after operation for 5 minutes.

Note: Use the parts such as a gauge manifold and charging hose only for specified refrigerant shown on the equipment.

4-2 Piping connection after flushing operation

(1) Piping connection with outdoor unit

To connect the piping kit (field work) with the outdoor unit, connect piping by following the procedure below.

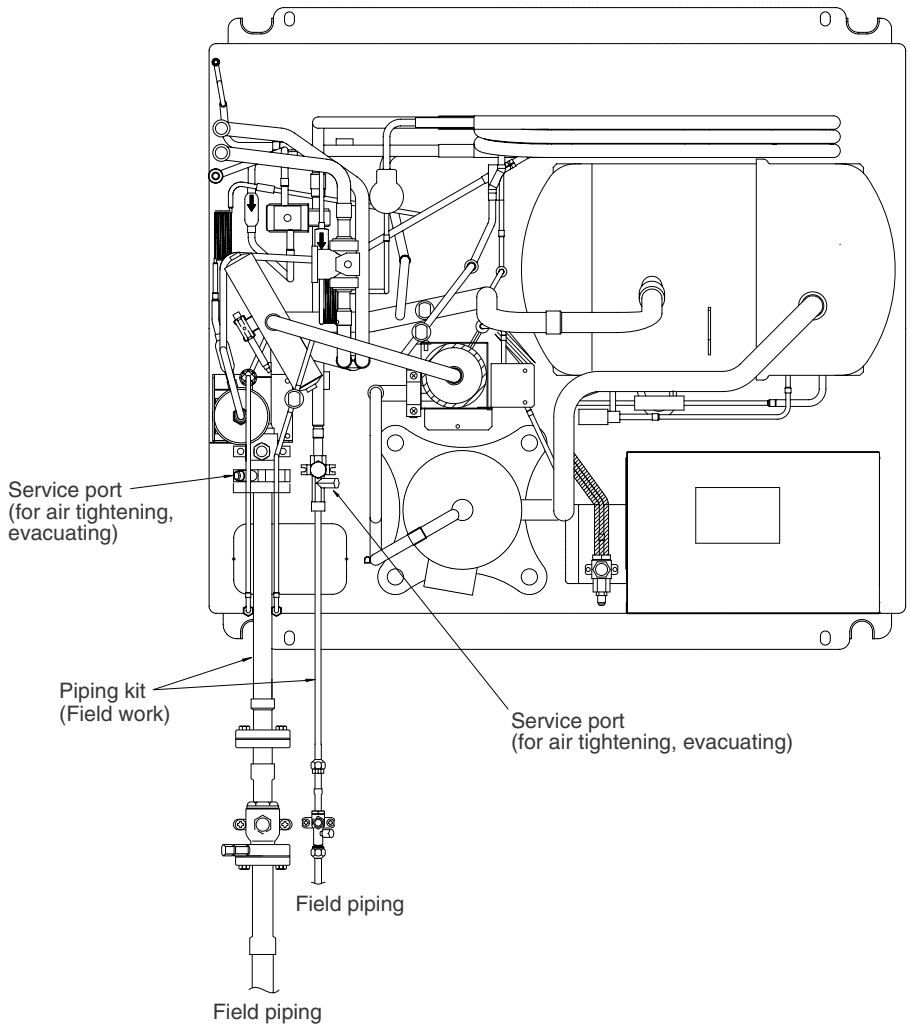
(1) After closing the service valve (ball valve) of the outdoor unit, valve mounted to the extended piping and oil trap kit, remove the piping connecting the outdoor unit, valve mounted to the extended piping and oil trap kit.

(2) Connect the piping kit (field work) to the outdoor unit. In this case, use the parts (short copper pipe, flare) provided with the outdoor unit.

(3) After air tightness* and evacuating the inside of the piping kit, open the service valve inside the outdoor unit. (in the order of the extended piping to the outdoor unit).

*(Conduct air tight test and evacuation from the service port of the service valve (ball valve) at the upper side of the outdoor unit. For the work procedure, refer to 4-1 (3) Air tightening/evacuating of flexible tube.)

In the case of P200 • 250YREM-A

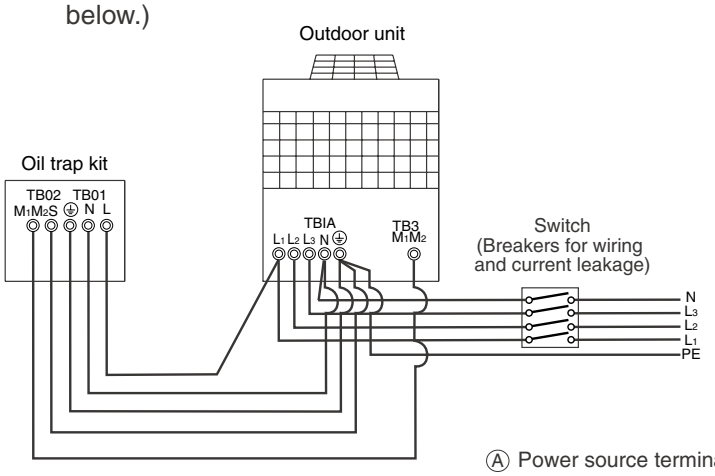


5. Electrical wiring work

5-1 Wiring connection before flushing operation

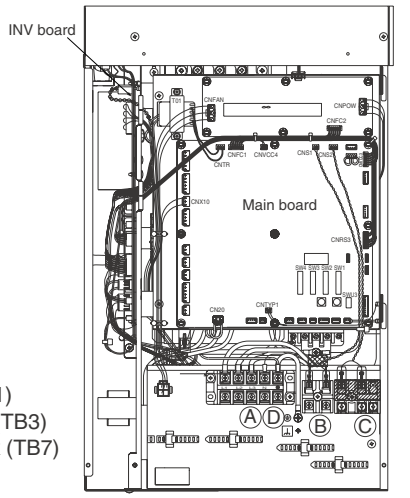
(1) Wiring connection with outdoor unit

(1) Remove the control box cover of the outdoor unit. (The state within the control box cover is shown below.)



Ⓐ Power source terminal block (TB1)
Ⓑ Transmission line terminal block (TB3)
Ⓒ Centralized control terminal block (TB7)
Ⓓ Earth (⏚)

In the case of P200 · 250YREM-A

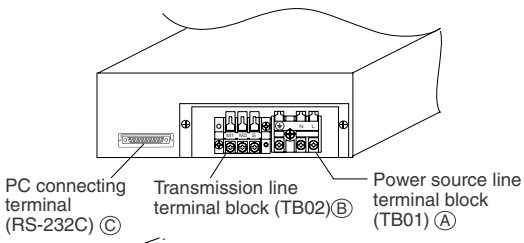


(2) Connect the transmission line of the oil trap kit to the terminal block for outdoor unit transmission (TB3), and the shielded earth line to the earth screw (⏚).
Connect the power source line of the oil trap kit to the terminal block for outdoor unit power source (TB1A) (Refer to the figure above.) or to individual power source by using a power cord with plug.

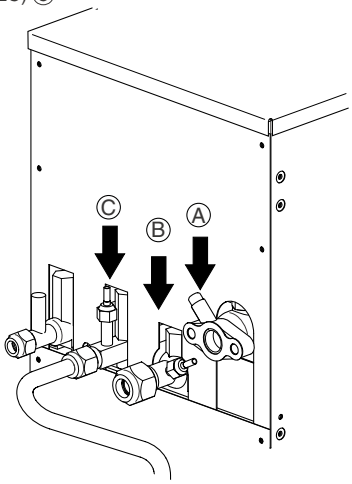
Wire thickness for power supply (mm^2)		Transmission cables (mm^2)
Main cable	Grand	1.25 or more VCTF, VCTEK, CVV, CVS, VVR, VVF, VCT or shielded wire CVVS/CPEVS
1.5	1.5	

Notes: 1. Specific wiring requirements should adhere to the local wiring regulations of the region.
2. Power supply cords of parts of appliances for heat source use shall not be lighter than polychloroprene sheathed flexible cord (design 245 IEC57).
3. When the power source is supplied from the outdoor unit as shown in the figure above, the protection of the oil trap kit relies on the switch installed on the outdoor unit. Therefore, be sure to install the switch on the outdoor unit.

(3) Remove the screws (2 pcs.) of the terminal block cover of the oil trap kit, connect the transmission line to the transmission line terminal block (TB02), the earth line to the earth screw (⏚), and the power source line to the power source line terminal block (TB01). Connect the earth of shielded wire only to the outdoor unit, and apply insulation to the oil trap kit side. (The state in the terminal block cover is shown below.)

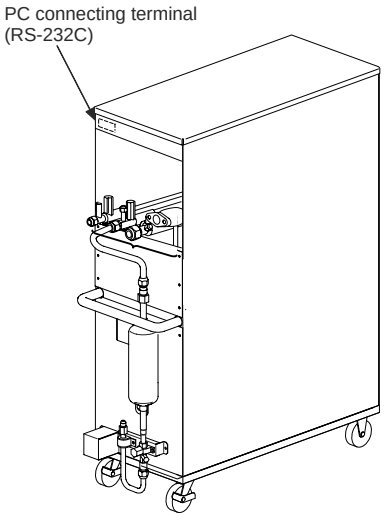


(4) Connect wiring to the oil trap kit through the square holes (two spots at the center) on the left panel. In this case, be careful not to allow wirings to contact each other.



(2) Wiring connection with PC

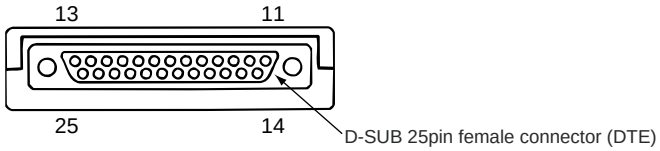
(1) Connect RS-232C connecting cable (field supply) suitable for the PC to the PC connecting terminal of the oil trap kit.



Connection with PC :

The oil trap kit is equipped with D-SUB25pin female connector (DTE) for the connection to the PC.

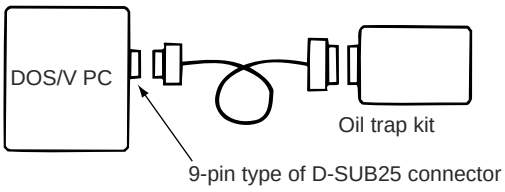
Connect by using RS-232C cross cable (length : 15m or less) marketed.



Request:
In accordance with the type of the serial interface for the PC to be used, select the RS-232C cable for use.
(The D-SUB connector of the oil trap kit is of 25 pins.)

The standard for selecting RS-232C cable is given below.
(For the connector with a special shape, consult the dealer of the PC.)

Connection with DOS/V PC



⚠ Caution
For the cable of D-SUB connector use, prepare the **cross cable** of 9 pin-25 pin. Otherwise abnormal communication may be caused.

⚠ Caution
Connect RS-232C cable while removing M-NET transmission line. Otherwise trouble may occur.

(3) Address setting

Unscrew the screws (2 pcs.) of the control box at the oil trap kit, and set the address. The range of address setting for the oil trap kit is 00 ~ 99. Select the address that is not being used by the indoor units, outdoor units, remote controllers and PC.

5-2 Wiring connection after flushing operation

(1) Wiring connection with outdoor unit

(1) Remove all wiring (power source wiring, transmission wiring) connected to the oil trap kit i.e. the original state before connecting the oil trap kit.

6. Connection work on rainy days

Please refrain from working on wiring and piping on rainy days. If the work is conducted, provide proper covering with vinyl sheet while paying attention to the items below.

(1) Prevent rain water from entering the piping.
(2) Be careful not to expose the electrical parts of the outdoor unit and oil trap kit to rain fall.
(3) Be careful not to touch the wiring with wet hands. Otherwise electric shock may be caused.

7. Flushing operation

(1) Installation method of S/W

Items to be prepared:

- REPLACE MULTI Setup Disk
- PC

  DOS-V machine (with CD ROM) WINDOWS95, 98, NT 4.0, 2000, ME or XP

Recommended conditions

CPU	:	300MHz or more
Memory	:	64MByte or more
HDD	:	40MByte or more
OS	:	WINDOWS 2000 or later

Installation method:

1. Set the [REPLACE MULTI Setup Disk] to the CD-ROM drive of the objective PC.
2. Execute the setup.exe of the CD-ROM drive and install by following the instruction displayed on the screen.

Starting method of S/W for replacing:

1. Click the [START] button and click the [PROGRAM].
2. Click the [REPLACE MULTI] and start the S/W for replacing.

Request:
When flushing operation can not be executed normally, do not change the set time of the PC during the working of the S/W for replacing.

(2) Items to be confirmed before flushing operation

1. Set the address of the oil trap kit within a range of 00 ~ 99 not using the address being used by the outdoor unit, indoor unit, remote controller and PC.
2. Set the communication port of the PC to “COM1.”
   Change it to “COM1” if it is being set to other than “COM1.”
   Otherwise the flushing operation can not be executed.
3. (Only required at the existence of indoor units of under Ver30 or LOSSNAY with heating humidifier of under Ver8.08 : Will be displayed on PC to remove)
   Remove the system controller connected to the indoor/outdoor transmission line and MA remote controller grouped with different refrigerant systems. Reconnect them after flushing operation.

(3) Starting and finishing of flushing operation

Flushing operation procedure (1)

❇ The abbreviations used in this manual and on the PC screen display represent as follows;

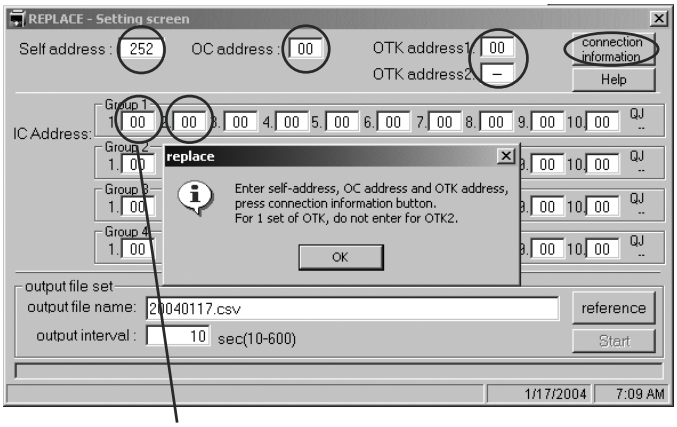
OC	:	Outdoor unit	Ope Mode	:	Operation mode	Oil R.	:	Low frequency oil recovery
OTK	:	Oil trap kit	D. F.	:	Defrosting			
IC	:	Indoor unit	F. P.	:	Forcible powering	Ref. R.	:	Refrigerant recovery
RT	:	Replace tank	Oil E.	:	Oil equalizing	S. SH	:	Shell bottom SH

Program version

Click the [REPLACE MIULTI] of the [PROGRAM] menu.

↓

Enter the self address
Enter the address within 1 ~ 253 not using that being used by OC, OTK, IC and remote controllers.
(The default value is set to 252.)



IC address input is not necessary.

↓

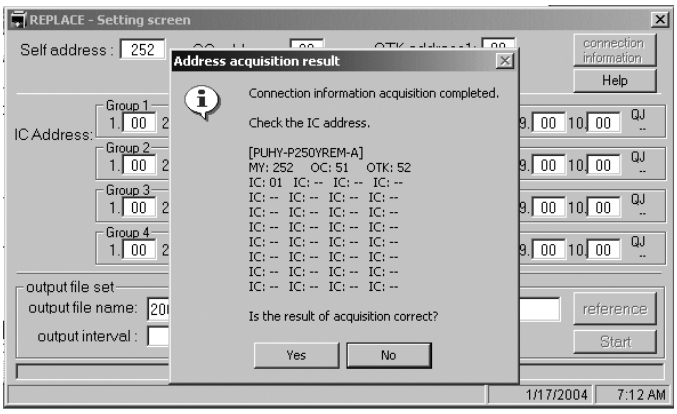
Enter the OC address.

↓

Enter the OTK address 1.
Do not enter the OTK address 2.

↓

Click [Connection information].

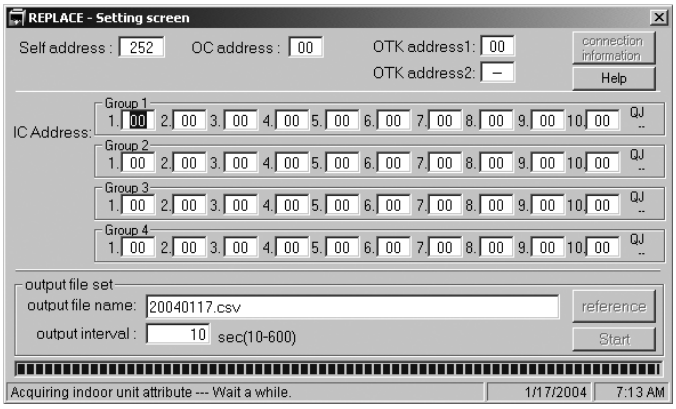


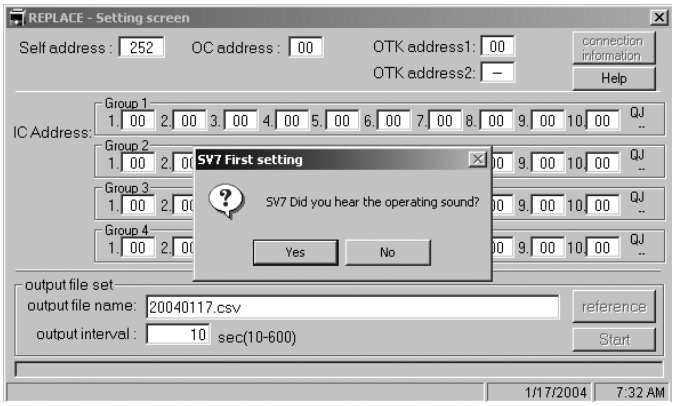
↓

Confirm the display of information connection monitored result. Click [YES] if it is correct.

Confirm the outdoor unit model name, self (MY) address : PC address, OC, OTK, IC addresses and connected numbers.

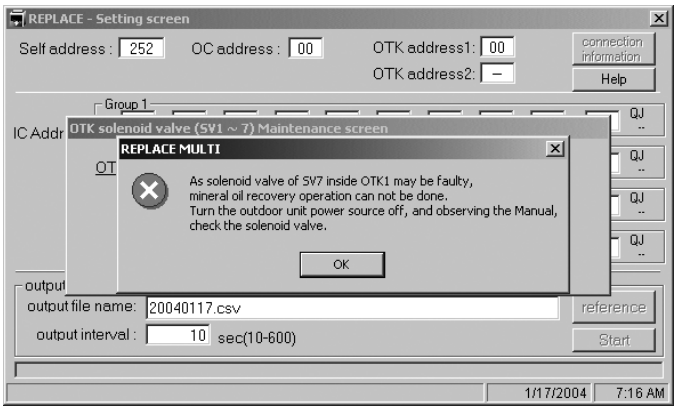
When it is not correct, click [NO] and check the connecting status of OC, IC, etc.





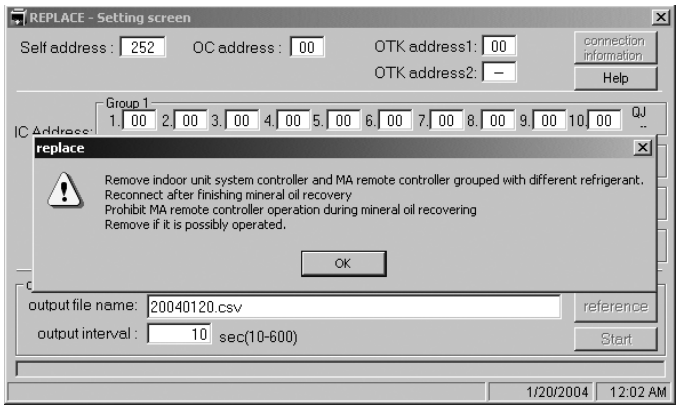
↓

Open and close all solenoid valves inside OTK, and check the operating sound of the solenoid valves. (Opens/closes starting from SV1 in order)


REPLACE - Setting screen
Self address : 252
OC address : 00
OTK address1: 00
OTK address2: –
connection information
Help
OTK solenoid valve (SV1 ~ 7) Maintenance screen
REPLACE MULTI
As solenoid valve of SV7 inside OTK1 may be faulty,
mineral oil recovery operation can not be done.
Turn the outdoor unit power source off, and observing the Manual,
check the solenoid valve.
OK
output file name: 20040117.csv
output interval : 10 sec(10-600)
reference
Start
1/17/2004
7:16 AM

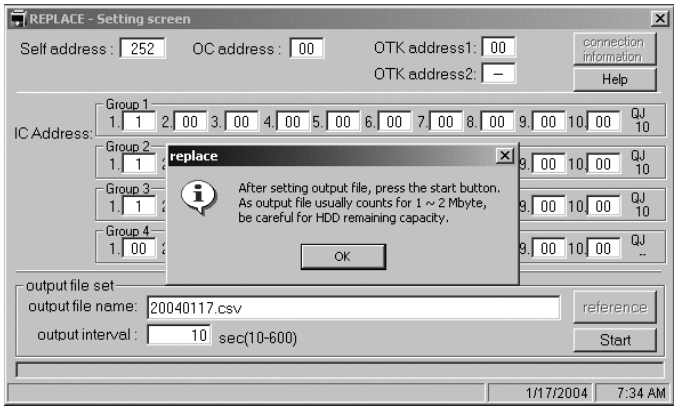
↓

In checking the solenoid valve operating sound for existence, clicking [NO] opens/closes the solenoid valve for 2 times, while clicking [NO] for three times continually displays as shown left. Check the solenoid valves inside OTK in such case.



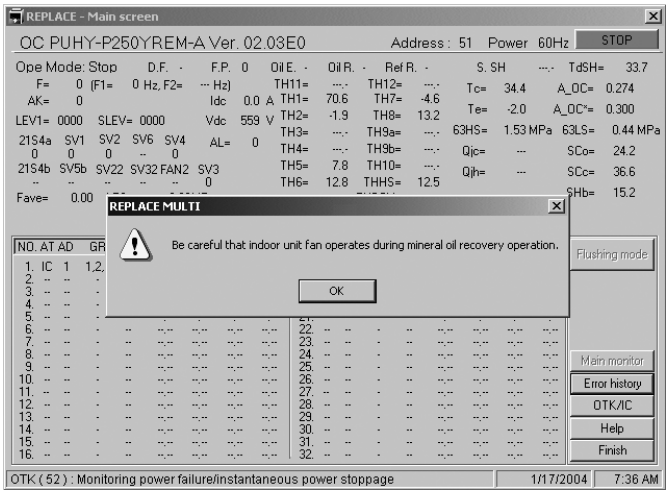
When the system controller is connected to the indoor/outdoor transmission line or MA remote controller is grouped with different refrigerant systems, shut off the outdoor unit power source and remove the system controller and MA remote controller. After removal, apply the power source and press the OK button.
If the left display is not shown, it is not required to remove the system controller and MA remote controller.

↓



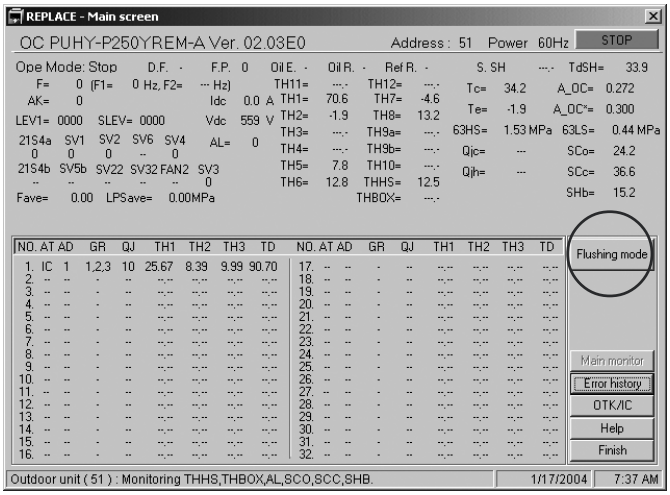
Click [Reference] and set the storage location and file name of the output file.
(The default setting is the ¥program files ¥replacemulti¥ (date).csv.)

Clicking [Start] moves to the main screen.



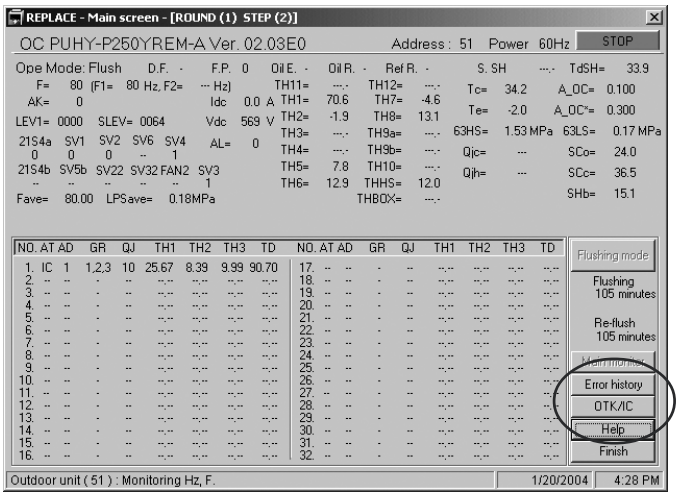
↓

Be careful that the indoor unit fan operates during flushing operation. Avoid working on the internal part of the indoor unit during flushing.



↓

Clicking [Flushing mode] initiates flushing operation.



Below the [Flushing mode] button, the remaining time to complete the flushing operation and the estimated time required for re-flushing are displayed.

(As the remaining time only represents for the standard. It may change during the operation.)

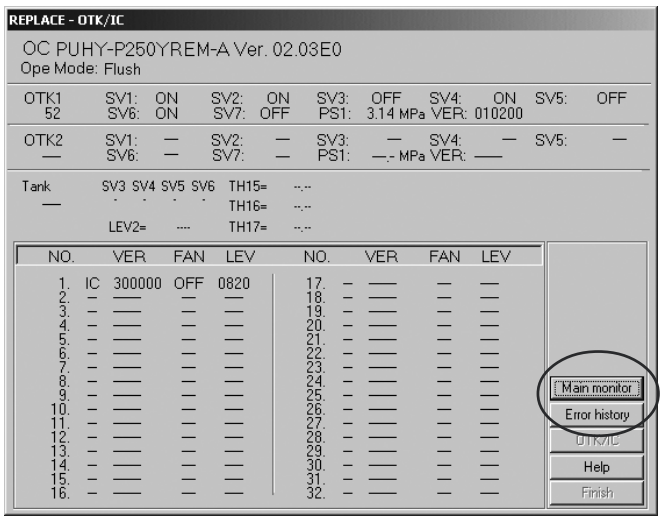
⚠ **Caution**

(1) Operating sound may generate during the flushing operation. This is caused by the switching operation of the solenoid vale not representing malfunction.

(2) Be careful that the piping (flexible tube) may be heated to high temperature during flushing operation.

↓

Clicking [OTK/IC] displays the monitor display screen of OTK and IC.



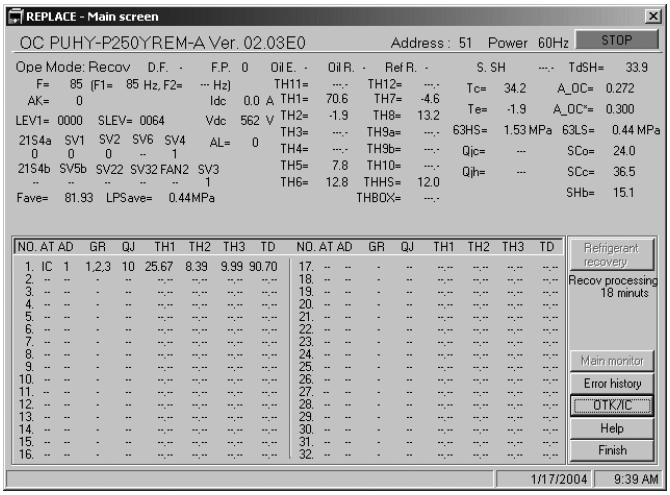
↓

Clicking [Main monitor] returns to the main monitor screen display.

Standard of flushing operation time

The flushing operation time differs depending on the insufficient quantity of refrigerant, outdoor temperature and outdoor wind.
In addition, the flushing time will be prolonged when the mean value of frequency, Fave, is lower than the target frequency.
When the outdoor temperature drops below 20˚C or the mean value of the low pressure, LPsave, lowers below 0.46MPa, install the low temperature hood after checking the refrigerant quantity and the opening/closing status of the valves.
However, please note that the low pressure (63LS) may drop during 30 minutes after starting flushing operation caused by the initial status of refrigerant. Always take the operating condition into your account for proper operation.
The standard of flushing operation with insufficient refrigerant is given by the table below.

	LPSave > 0.51[0.56]	0.51[0.56 ≥ LPSave > 0.41[0.46]	0.41[0.46] ≥ LPSave > 0.34	Target frequency
PUHY-P200YREM-A	2 hours	3 hours	4 hours	65Hz
PUHY-P250YREM-A				78Hz
Refrigerant charge	No insufficient refrigerant	Insufficient refrigerant –10%	Insufficient refrigerant –30%	

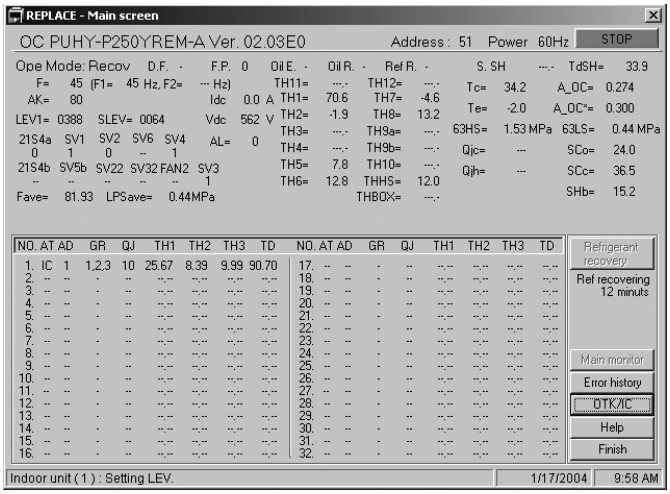


↓

After finishing flushing operation, refrigerant recovery operation will be executed.
The remaining time of flushing operation is displayed below the [Refrigerant recovery] button.
The recovery processing now is displayed for 18 minutes after starting refrigerant recovery operation, while the refrigerant recovered is finishing.

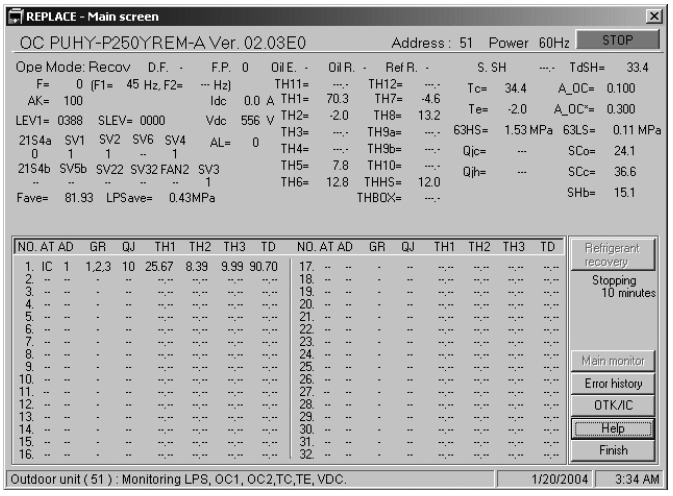
❇ The time required by the recovery processing and the refrigerant recovered is shown individually.

❇ When the unit is stopped during the recovery processing, it will be continued for 51 minutes.

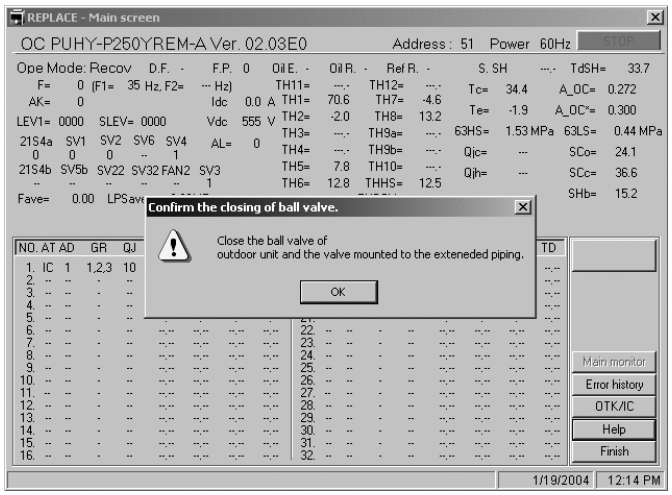


↓

If the value of the low pressure (63LS) drops below 0.11MPa during recovering refrigerant, the compressor stops with the display of [Stopping]. (Be careful, the outdoor fan rotates in full speed even in stopping!)
After stopping for 1 minute, the compressor restarts with the display of [Ref recovering].

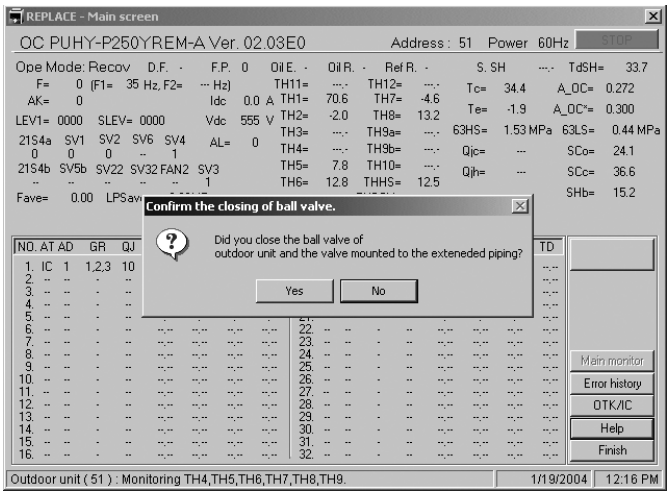


Flushing operation procedure (2)



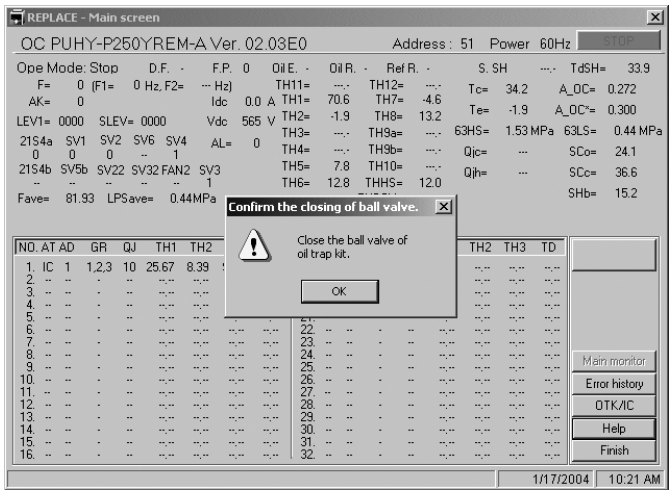
↓

After finishing refrigerant recovery operation, the left screen appears. On this screen, close the ball valve of the outdoor unit and the valve mounted to the extended piping, click [OK].



↓

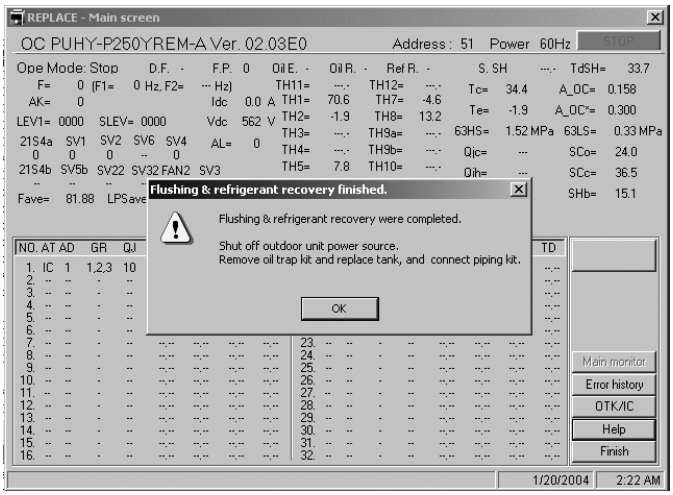
After confirming the closing of the ball valve of the outdoor unit and the valve mounted to the extended piping, click [YES].



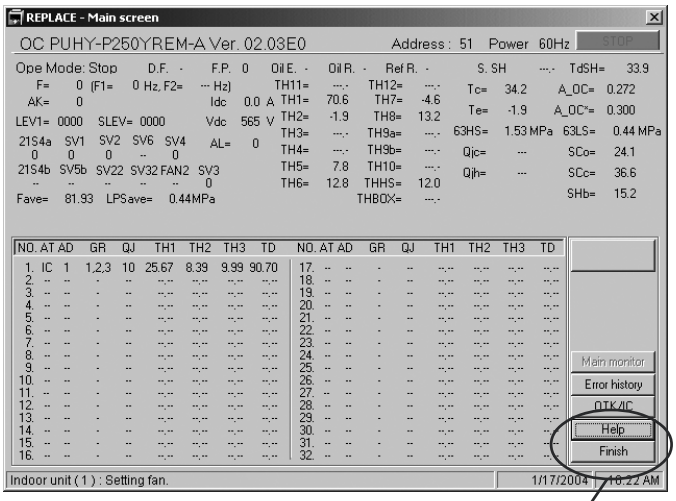
↓

After opening the solenoid valve for several seconds, the left screen appears. On this screen, close the ball valve, and click [OK].

Flushing operation procedure (3)



For Y series



Finishing of monitoring

↓

After turning the power source of OC and OTK off, recover mineral oil inside the oil trap kit and remove the piping (flexible tube) between the outdoor unit and oil trap kit.
After connecting the piping kit (field work), execute evacuation.
After evacuation, open the ball valve of the extended piping and OC that in order.
Then remove the replace tank and confirming it has no residual oil.
After completing the above work, click [OK].

⚠ Caution
Do not turn off the power source nor remove OTK before displaying the left screen.

⚠ Caution
(1) Before removing OTK, discharge the recovered mineral oil through the mineral oil recovery service valve. Dispose the discharged oil in the field. (The oil pan should be prepared in the field.)
(2) The job site is desired to be outdoor or a place with ventilating facility.
(3) To operate the oil recovery service valve, do it slowly using leather gloves or the like.
(4) Recover mineral oil until the continuous discharge of the liquid (recovered oil) from the oil recovery service valve stops. (The state of spraying or dripping is acceptable.)
(5) When removing the piping (flexible tube), note that inside the piping contains gas refrigerant. Remove it after recovering the refrigerant.
(6) Confirm that the pressure inside the oil trap kit is stable within 0.049 ~ 0.294MPa with a pressure gauge.
When it is out of the above range, take countermeasures by confirming the inner pressure of the oil trap kit.

↓

Click [Finish], and turn the PC power source off.
❇To monitor the operation status, do not set to [Finish].

↓

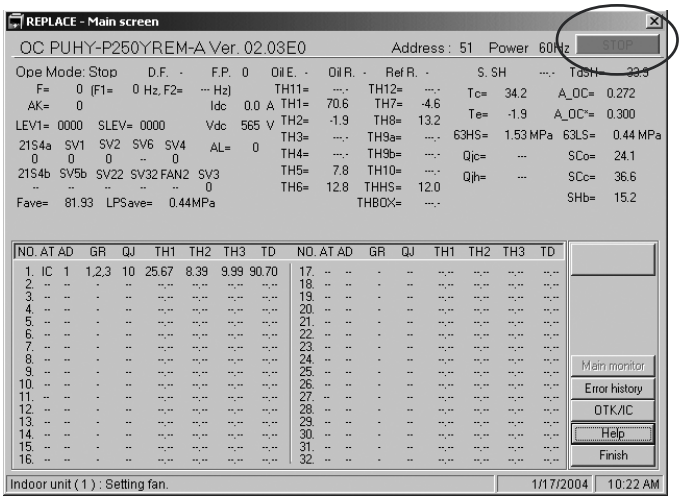
After that, remove the power source wiring between OC and OTK, and the connecting cable between OTK and PC.
❇To monitor the operation status, remove only the power source wiring between OC and OTK.

↓

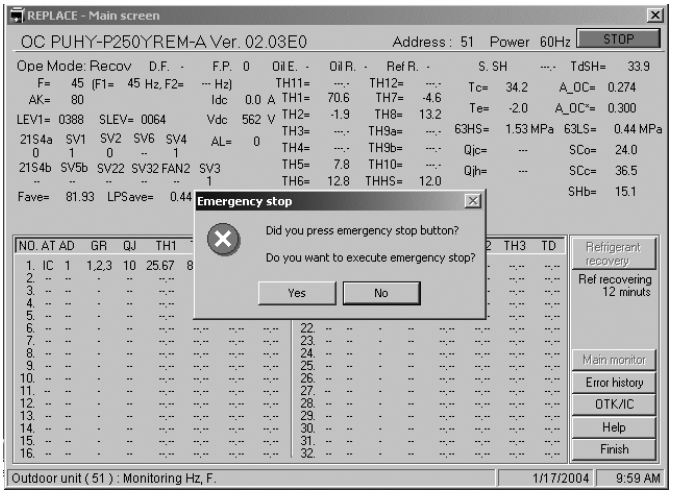
Turn the power source of OC on, and confirm the operation.
• To start confirming the operation, use the test run switch of the remote controller or OC.

Emergency stopping method

The work can be paused or suspended during the flushing operation and refrigerant recovery operation.



To pause the work, click [Stop].

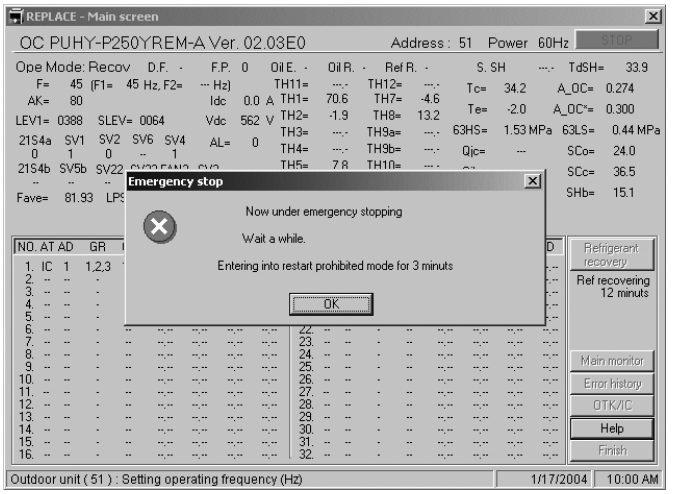


↓

At the display of the left message, click [YES].

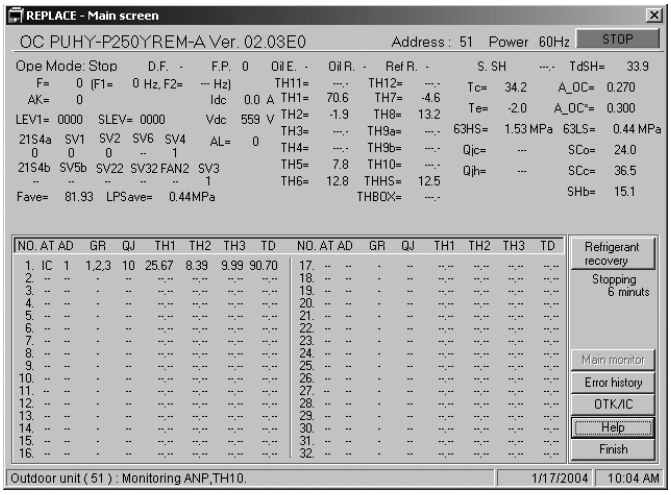
OC stops the operation of the compressor.

Clicking [NO] allows OC to operate continually.



↓

Click [OK] and confirm the stopping of the compressor.



↓

To restart the operation, click [Restart].
([Refrigerant recovery] during refrigerant recovery operation)
([Restart] does not appear within about 3 minutes after stopping.)
To suspend the operation, click [Finish].

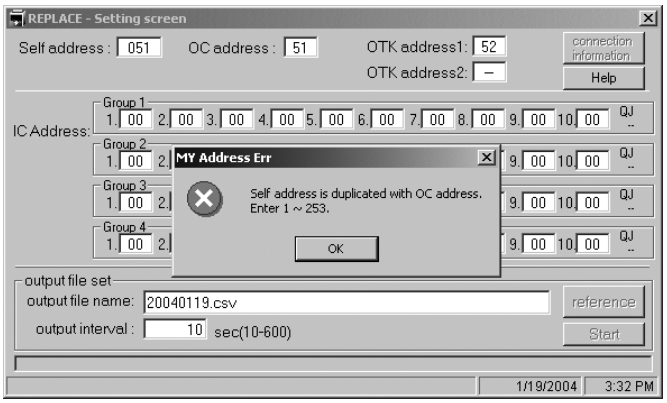
⚠ Caution

At the restarting after pausing the work, the operation restarts from one step before that paused (about 5 minutes) after operating for initial processing (for about 15 minutes).

Display at erroneous input and detection of abnormality

At erroneous input or when abnormality is detected during operation, a message corresponding to the content of erroneous input or abnormality will be displayed.
Conduct input and inspection work by following the message displayed on the screen.

Display example of erroneous input
(Erroneous input of self address)



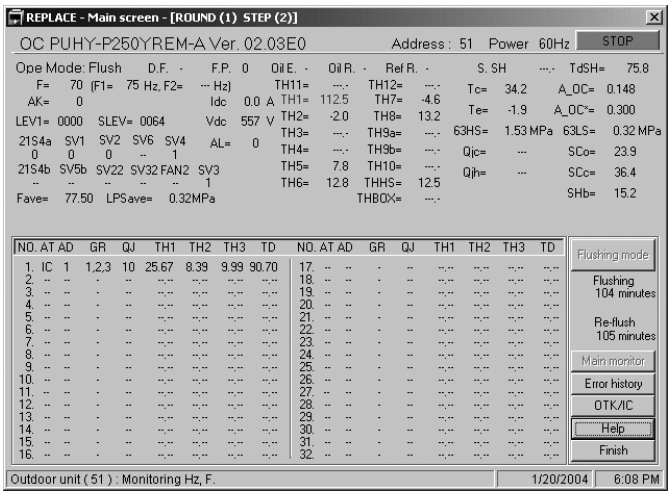
Display example of detecting abnormality
(Detection of abnormal high pressure : [Error code 1302])

Error stopping mode
High pressure error detected. (1302)
Refer to Service Handbook, Mineral oil recovery work Manual.
Stopping refrigerant recovery mode.
Entering into 3-minute restart prohibit mode.
Thereafter press [Refrigerant recovery] button.
OK

Display of insufficient flow rate during backup control

• Backup control

The backup control includes that for high pressure, discharge temperature (compressor shell temperature), radiator plate temperature (THHS), and secondary current (bus current), and the item presently backed up is shown in red color. The red color display continues until returning to normal control.

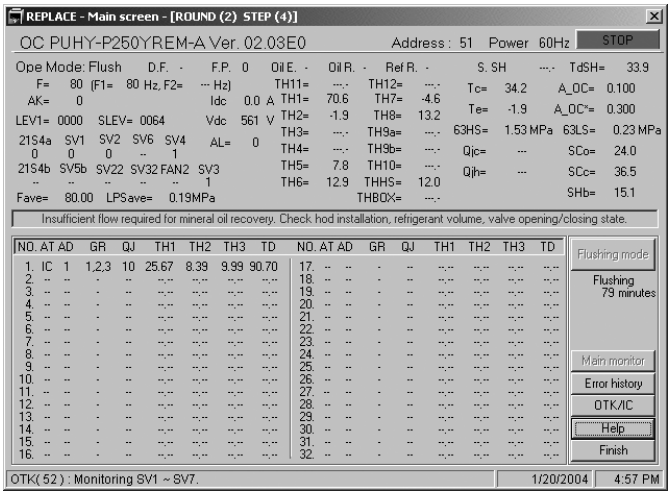


• Insufficient flow rate

When an extremely insufficient flow rate is detected during flushing operation, the following message is displayed.

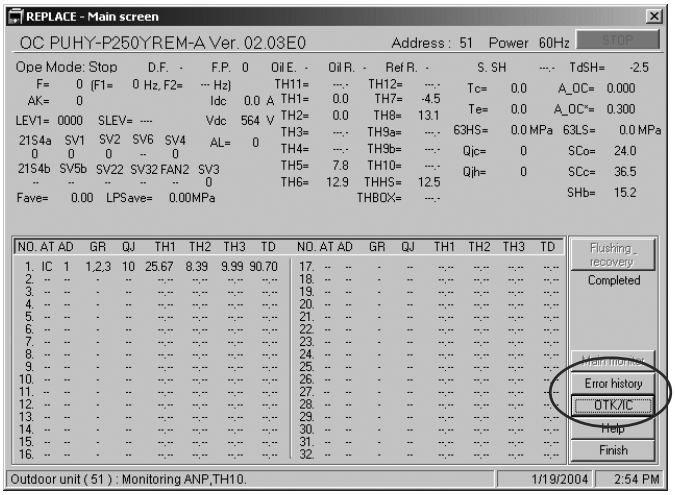
Execute inspection and countermeasure by following the message displayed on the screen.

As the low pressure (63LS) may drop depending on the initial refrigerant status for 30 minutes after start of flushing operation, please take proper measures while observing the operating condition.



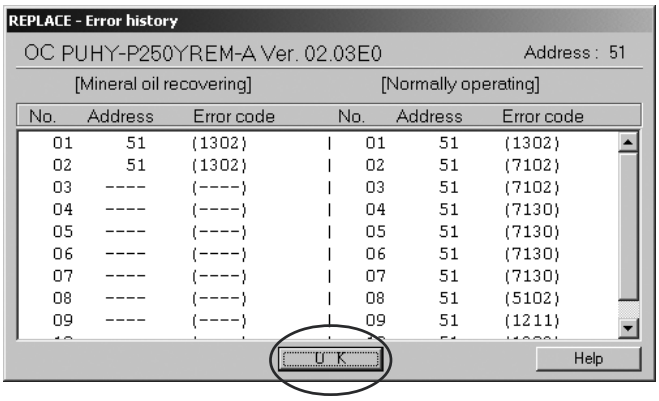
Display at operation status confirmation and abnormal history

The operating status of OC and IC while confirming their operation may be monitored.
(Do not remove the transmission line of OTK after flushig operation and refrigerant recovery.)
Note: Effective only to monitor the operating status by using PC.



Clicking [Error history] displays the history of abnormality.

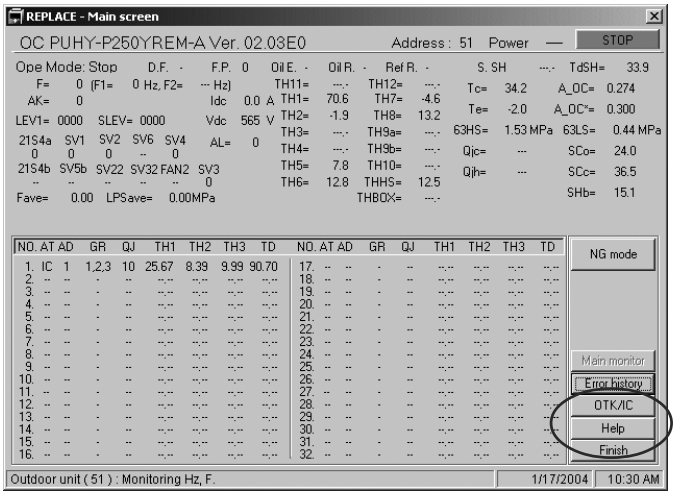
- ❇ Displays the abnormality history both under mineral oil recovery and normal operation.
- ❇ During mineral oil recovering, the abnormality history under normal operation is not displayed.



↓

Clicking [OK] returns to the main screen.

Reading of mineral oil recovery work manual

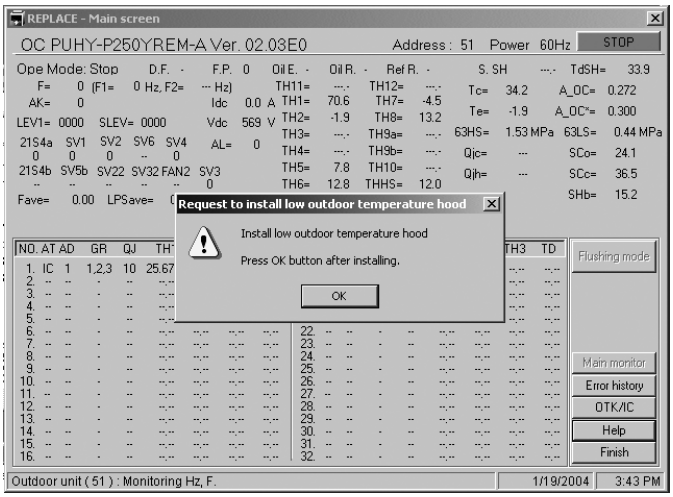


Clicking [Help] allows you to read the mineral oil recovery work manual in the form of PDF file.

Caution
To read PDF file, Acrobat Reader is required.

(4) Mounting method of low outdoor temperature hood

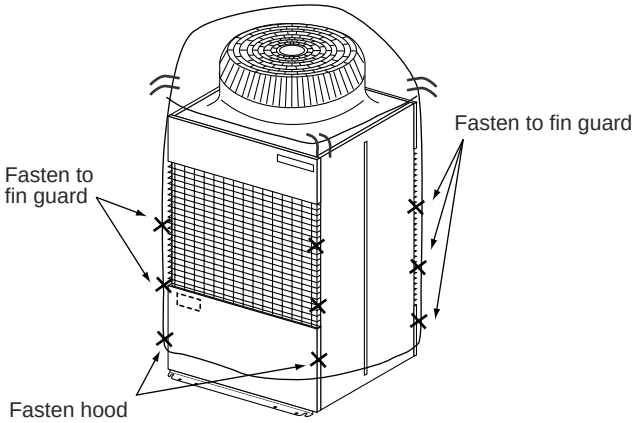
Upon the request to install the low outdoor temperature hood displayed on the PC as shown below, mount the low outdoor temperature hood provided with the oil trap kit.



(1) Installation condition : Mount hood at TH6 = 20˚C or less.

(2) Mounting method : Place the hood to cover the outdoor unit from the top, fasten it by putting the spring for fixing between the fin guard at the front and rear sides.
When it is left for a long time during the night, be careful not to loose the springs.

In the case of P200･250YREM-A



❊Although the standard is TH6 = 20˚C or less, the hood is required to be mounted to protect against any outdoor wind or rain interfering with the flushing operation.
In the case when the discharge pressure, 30 minutes after starting flushing operation is (63HS) < 20kg/cm^2, or the mean value of low pressure, LPSave, is less than 0.46.
As the low pressure (63LS) may drop depending on the initial refrigerant status for 30 minutes after start of flushing operation, please take a proper measure while observing the operating condition.
In the case of TH6 > 43˚C, adjust the hood vertically for TH6 ≤ 43˚C.
When the outdoor low temperature hood can not be mounted due to the centralized installation system, remove the spring for fastening.

IV. Work Procedure at Oil Inspection

1. Oil inspection after mineral oil recovery

List of oil inspection parts (for mineral oil)

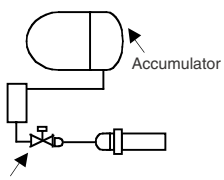
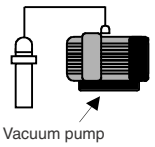
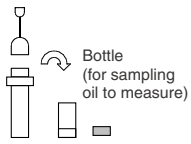
Parts name		Application	Specification	Remarks
(1)	Ester oil sampling kit	Oil sampling inside outdoor unit	Vessel (1pc.), Bottle (2pcs. [1pc. charged with oil)] Filler (2pcs.)	
(2)	Portable refractometer	Measuring of oil refractive index	Recommended maker : K.K. Atago Product No. : N-3000E	Purchased Atago product your agent
(3)	Oil pan (field supply)	Oil recovery vessel		

❇ (2) For the portable refractometer, read the instruction manual carefully before use, understand its function and operation fully.

Dealer of Atago products (As of December 2003)

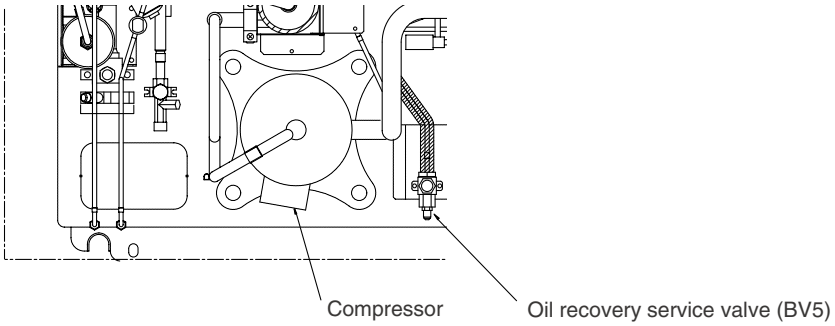
Country	Distributor	TEL	FAX
Belgium	Analis	32-9-243-77-19	32-9-220-08-48
Germany	LEO KUEBLER	0721/22491+21090	0721/27903
	Kleinfeld Labortechnik GmbH	49-5108-9298-15	49-5108-9298-98
France	Fisher Bioblock Scientific S.A.	33-3-88671414 33-3-88-675359	33-3-88671168- 33-3-8867-1125
Italy	ANALYTICAL CONTROL S. P. A.	39-02-6122841	39-02-6127646
Netherland Luxembourg	GOFFIN MEYVIS	31-76-5-86000	31-76-5086086
Denmark	Bie & Berntsen A-S	45 44 94 88 22	45 44 94 27 09
Ireland England	JENCONS SCIENTIFIC LTD	44-1525-372010	44-1525-853617
Greece	P. BACACOS S. A. (ATHENS)	30-210-5232-631	30-210-5229-141
Spain	GOMENSORO, S. A.	91-508-6586	91-508-6511
Portugal	CONCESSUS, S. A.	351-21-387-2406	351-21-388-5950
Finland	BERNER	358-9-134511	358-9-13451384
Austria	VWR International GmbH	43-1-57600-323	43-1-57600-350
Sweden	TAMRO MEDLAB AB	46-31-706-3000	46-31-706-3030

(1) Oil sampling method

Work flow	Work content
Take the following items to site: ester oil sampling kit, portable refractometer and tools	Checking required parts
Operating outdoor unit, collecting oil (for dispensing, sampling)	1. Operate outdoor unit. 2. Place oil pan and open for 1/2 seconds to collect oil from oil recovery service valve, and dispense the recovered oil. 3. 20 minutes after recovering oil of “2” mount the vessel (for sampling of oil to be measured) attached to ester oil sampling kit, and open it for 1/2 seconds to collect oil. 
Evacuating vessel (sampling of oil for measurement)	Evacuate the vessel (for sampling oil to be measured). **Caution:** (1) Laying the vessel horizontally for evacuation discharges oil together with air. Evacuate while standing vertically. (2) After reaching a vacuum degree of 650Pa, evacuate for about 15 seconds or more and leave it for 15 seconds to confirm that the vacuum degree does not rise. (3) Be careful error may be caused by insufficient evacuation. (4) Working below 20˚C, the desired vacuum degree can be attained sooner if evacuating while heating the vessel with a dryer. (about 10 minutes) 
Move the oil inside vessel (for sampling oil to be measured) to the bottle (for sampling oil to be measured)	Loosen the flare nut of the vessel (for sampling to be measured), open the bottle (for sampling oil to measure) cap, and pour the oil inside the vessel (for sampling oil to be measured). **Caution:** (1) Open/close the flare nut with two spanners. (2) Wipe off water content adhered to the vessel (for sampling oil to be measured) not allowing water enter into the bottle (for sampling oil to be measured). 

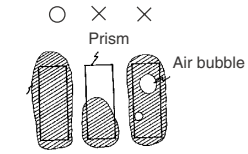
Work flow	Work content
Adjusting temperature of bottle charged with oil in the ester oil sampling kit and the bottle to which oil is moved (for sampling oil to be measured)	Leave the bottle charged with oil inside the ester oil sampling kit and the bottle (for sampling oil to be measured) for 50 minutes to allow the oil to moved under the same environment as the outdoor or indoor. Locate the refractometer in the same environment. **Caution:** Although the bottles may be located either outdoor or indoor, leave them in the same place where the refractive index explained later is measured.

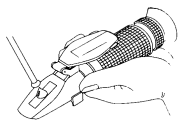
In the case of P200・250YREM-A

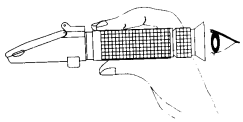


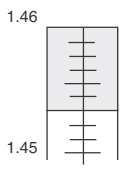
(2) Measuring method and judgment of refractive index

Work flow	Work content
Drip oil in the bottle inside the ester oil sampling kit into the portable refractometer.	Open the cap of the oil charged bottle in the ester oil sampling kit, collect oil by using the filler provided, and drip one or two drops onto the prism surface of the portable refractometer. **Caution:** (1) Coat oil so that it spreads over the prism surface. (2) When air bubbles are found, refrigerant may possibly be present. Move the oil to be measured to the vessel and evacuate it again.
↓	
Read the scale with the ocular mirror.	1. Direct the top end of the refractometer toward the direction of sun light, turn the ocular mirror to read the scale clearly while looking in the ocular mirror. **Caution:** (1) Measuring with direct solar radiation (sun light) may generate the coloring of the boundary line. Use soft lighting such as the reflecting light off a wall surface. Be careful, the sample oil loaded may drip while reading the scale. (2) Grasping the refractometer with your whole hand during measuring may give your body heat to the meter causing possible error. (3) When the boundary line is vague despite ocular adjustment, refrigerant may be dissolving. Move the oil to be measured to the vessel, and evacuate it again. Refrigerant can also be removed by opening/closing the light collecting plate (for about 20 times). 2. As the boundary line separating bright and dark sections horizontally appears in the visual field, read the scale on the boundary line. (Down to the 4th decimal point Example : 1.4530)
↓	
Remove oil adhered to the prism surface.	By using a soft tissue paper damped with water, wipe off the prism surface, light collecting plate and its surrounding, and further wipe off water content with a dry tissue paper. **Caution:** (1) As the prism is soft, be careful not to damage it during wiping. (2) As the contaminated prism surface may cause an error or make the boundary line vague, always keep it clean by wiping.
↓	
Apply the same operation to the bottle (for sampling oil to be measured).	
↓	





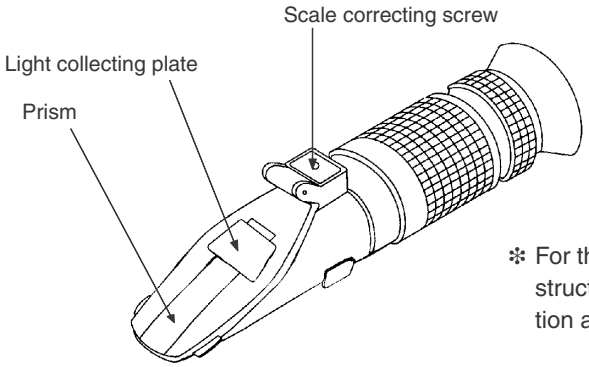




Judgement [A difference of the refractive index between the oil charged bottle and the bottle (for sampling to be measured)]

+0.0015 or less	+0.0015 exceeded
↓	↓
Acceptable as it is.	Execute flushing operation again.

Sectional name of portable refractometer



❊ For the portable refractometer, please read the instruction manual to understand the sectional function and control method fully before actual use.

(3) Measures to be taken at oil inspection (Failure to pass oil inspection test) (No Good)

Parts list

	Parts name	Application	Specification	Remarks
(1)	Ester oil for REPLACE MULTI	Replenishment of ester oil (2L) to outdoor unit	Mounted to ball valve at both ends	• Service parts • Requires the quantity below for re-flushing operation of 1 time P200, 250YREM-A : 1 pc.
(2)	A complete set of parts for mineral oil recovery operation	Execution of flushing operation	Refer to III. Mineral oil recovery operation method.	• Not required for the re-flushing operation of less than 2 times
(3)	Valve (field supply)	For evacuation	–	
(4)	Charging hose (field supply)	Connection with outdoor unit	–	
(5)	Gauge manifold (field supply)	Checking of oil flow	–	

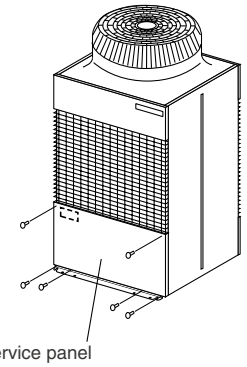
Method of re-flushing operation

Depending on the difference of refractive index of the oil charged bottle (for sampling oil to be measured) with a refractometer, conduct cooling/heating operation and re-flushing operation (“NG mode” program for reflushing) for the rated frequencies as shown below. (Repeat the operation of (A)~(D) as follows.)

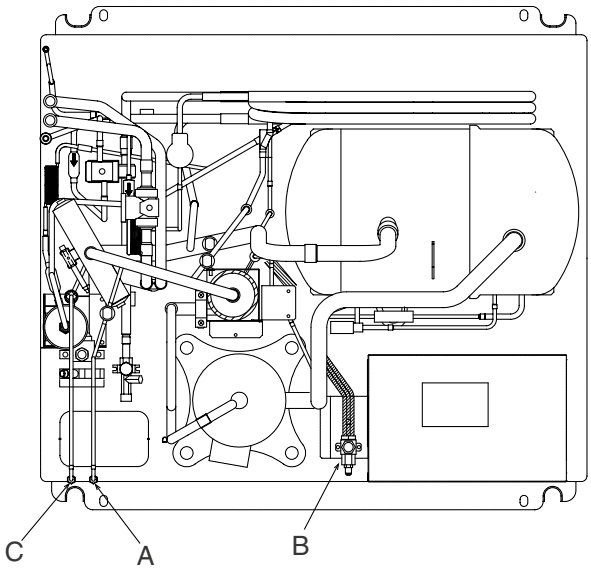
Difference of refractive index	Frequency of re-flushing operation	Operation method
0.0015 ~ 0.0025	1 time	Replenish and recover (1) ester oil for REPLACE MULTI while conducting cooling/heating operation.
0.0025 ~ 0.0040	2 times	
0.0040 ~ 0.0070	3 times	Replenish and recover (1) ester oil for REPLACE MULTI while conducting re-flushing operation.
0.0070 ~ 0.0115	4 times	

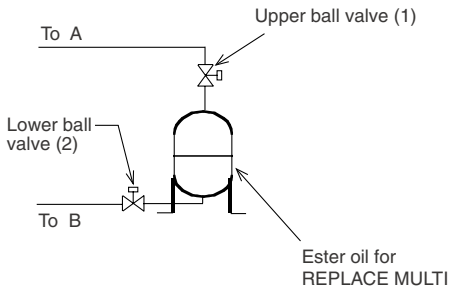
Replenishment/recovery of ester oil under cooling/heating modes

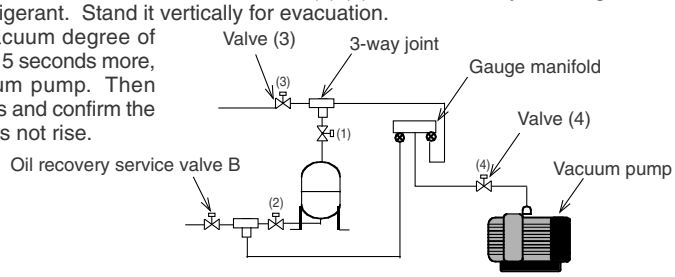
Work flow	Work content
Carrying in ester oil for REPLACE MULTI and tools	Checking the required parts
Mounting the ester oil sampling kit for REPLACE MULTI (A)	1. Unscrew 6 screws on the outdoor unit front panel, and remove the front panel. 2. Connect the ball valve (2) at the lower part of the ester oil kit to the oil recovery service valve B, and the upper ball valve (1) to the service check joint (high pressure) A. **Caution:** When connecting the service check joint, firstly connect the valve (field supply) to mount the charging hose.



In the case of P200・250YREM-A

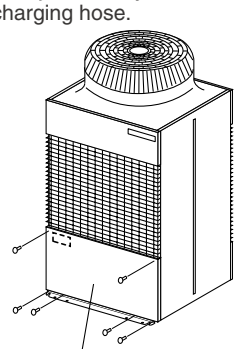




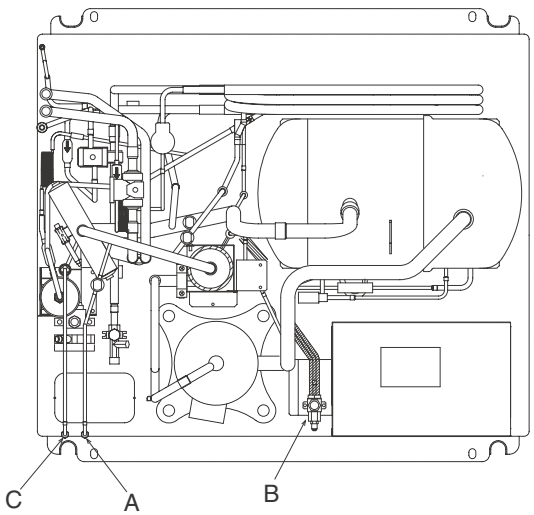
Work flow	Work content
Evacuating the inside of charging hose (B)	Evacuate the charging hose before and after the ester oil kit for REPLACE MULTI (by mounting the valve). **Caution:** (1) Evacuating with the ester oil kit for REPLACE MULTI (1) (2) laid horizontally discharges the oil together with refrigerant. Stand it vertically for evacuation. (2) After reaching a vacuum degree of 650Pa, evacuate for 5 seconds more, and stop the vacuum pump. Then leave it for 5 seconds and confirm the vacuum degree does not rise. 
Executing additional oil charging by opening valves (1)(2) (C)	1. After evacuation, close the valve (4) before the vacuum pump and the high/low pressure valve of the gauge manifold. 2. Open the valves (1) (2) of the ester oil kit for REPLACE MULTI, the valve (3) connected to the service check joint, and the oil recovery service valve B (4 in total), and add oil by operating all indoor units for cooling or heating. (For P200•250YREM-A per 1 time : 1 pc., additional oil charge) (open valves in the order of valve (3) connected to the service check joint, valve (1) to the REPLACE MULTI ester oil kit upper part, and valve (2) to the REPLACE MULTI ester oil kit lower part and the oil recovery service valve B.) The additional charge takes about 20 minutes per piece.
Changing the connecting position of valve (3) (A→C), Executing oil recovery (D)	1. After completing all oil replenishment, close valve (3) connected to the service check joint. 2. After closing valve (3) connected to the high pressure service check joint A, change the connecting point from A (high pressure) to C low pressure service check joint. At this moment, place the vessel of the REPLACE MULTI ester oil kit on a scale. 3. Open valve (3) connected to the service check joint, and recover oil for 2kg. 4. After recovering oil, close the oil recovery service valve B, ball valve (2) of the REPLACE MULTI ester oil kit, and valve (3) connected to the service check joint. (3 in total) 5. Open valve (4) before the vacuum pump and the high/low pressure valve of the gauge manifold, recover the refrigerant inside the REPLACE MULTI ester oil kit. 6. After recovering refrigerant, close the ball valve (1) of the REPLACE MULTI ester oil kit, valve (4) before the vacuum pump and the high/low pressure valve of the gauge manifold, and remove the REPLACE MULTI ester oil kit. ❊ Confirm that the oil quantity recovered inside the REPLACE MULTI ester oil kit is correct.
Confirming the operation (compressor starting)	After completing oil replenishing and recovering work, check the cooled (heated) air supply and compressor operating status.

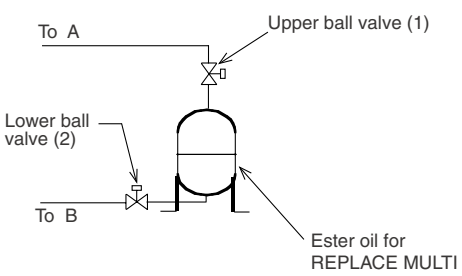
Replenishment/recovery of ester oil under re-flushing operation

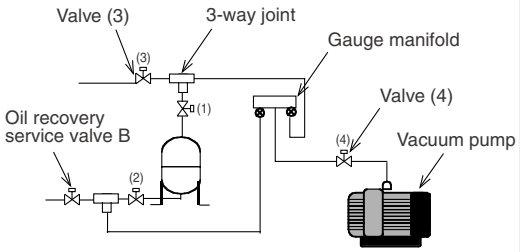
Work flow	Work content
Carrying in ester oil for REPLACE MULTI and tools	Checking the required parts
Installing the oil trap kit, branch piping kit and PC	1. Turn on the power source of the outdoor unit. 2. Remove the piping kit mounted between the outdoor unit and the valve on the extended piping. 3. Connect the outdoor unit and oil trap kit with piping (flexible tube). 4. Apply airtight test and evacuation to the piping (flexible tube) between the outdoor unit, valve mounted to the extended piping and oil trap kit. 5. Open the ball valves. [in the order of the oil trap kit (1)~(4), extended piping, and outdoor unit (1), (4).] 6. For the oil trap kit, apply from L1 and N of outdoor unit supply or a separate 220~240V supply power source of the outdoor unit and the transmission line from the outdoor unit TB3. 7. Connect the oil trap kit and PC. 8. Remove the system controller if connected to the indoor system. For detail, refer to 1~5 : Piping work and 6, 7 : Wiring connection.
Air tightening and evacuating the inside of piping (flexible tube)	
Mounting the ester oil sampling kit for REPLACE MULTI (A)	1. Unscrew 6 screws on the outdoor unit front panel, and remove the front panel. 2. Connect the ball valve (2) at the lower part of the ester oil kit to the oil recovery service valve B, and the upper ball valve (1) to the service check joint (high pressure) A. **Caution:** When connecting the service check joint, firstly connect the valve (field supply) to mount the charging hose.



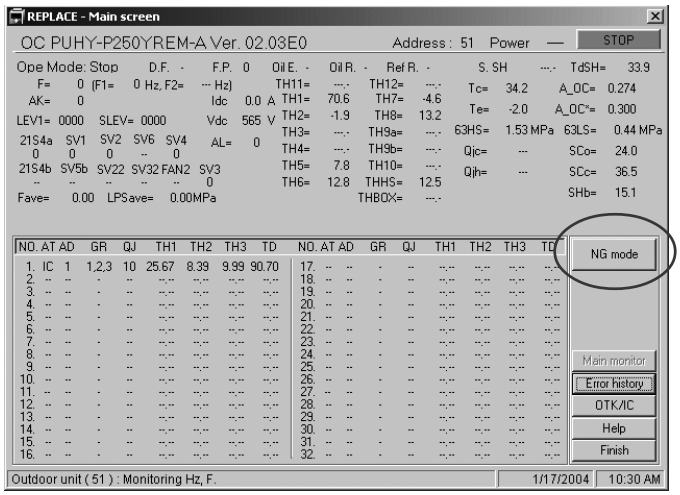
In the case of P200・250YREM-A





Work flow	Work content
Evacuating the inside of charging hose (B)	Evacuate the charging hose before and after the ester oil kit for REPLACE MULTI (by mounting the valve) by opening valve (4) before the vacuum pump and the high/low pressure valve of gauge manifold. **Caution:** A Evacuating with the ester oil kit for REPLACE MULTI (1) (2) laid horizontally discharges the oil together with refrigerant. Stand it vertically for evacuation. B After reaching a vacuum degree of 650Pa, evacuate for 5 seconds more, and stop the vacuum pump. Then leave it for 5 seconds and confirm the vacuum degree does not rise. 
Executing flushing again by opening valves (1)(2) (C)	1. After evacuation, close valve (4) before the vacuum pump and the high/low pressure valve of the gauge manifold. 2. Open the valves (1) (2) of the ester oil kit for REPLACE MULTI, valve (3) connected to the service check joint, and the oil recovery service valve B (4 in total), add oil, operate for recovery. (per 1 time : 1 pc.) (open valves in the order of valve (3) connected to the service check joint, valve (1) at the REPLACE MULTI ester oil kit upper part, and valve (2) at the REPLACE MULTI ester oil kit lower part, and oil recovery service valve B.) The additional charge takes about 20 minutes per piece. The recovery time takes about 24 hours.
Recovering oil inside the oil trap kit (D)	1. At about 20 minutes after starting flushing operation, close the ball valves (1) (2) of the REPLACE M MULTI ester oil kit, valve (3) connected to the service check joint and oil recovery service valve B (4 in total). (close valves in the order of the valve (3) connected to the service check joint, the REPLACE MULTI ester oil kit upper part ball valve (1) and lower part ball valve) (2).
Remove the oil trap kit and REPLACE MULTI ester oil kit.	1. After flushing operation, close the service valves of the outdoor unit, and valve mounted to the extended piping. (4 in total) 2. Close the service valves of the oil trap kit. (4 in total) 3. Turn off the power source of the outdoor unit once. 4. After flushing operation, recover oil by opening the oil recovery service valve. (Confirm that about 2 litters of oil is recovered.) ❇ The mineral oil recovered by flushing operation should be extracted for each time, and confirm that the pressure counts within 0.049~0.294MPa to proceed the work.
Reconnecting piping kit provided with outdoor unit, and conducting evacuation	1. Remove the piping (Flexible tube) between the outdoor unit, valve mounted to the extended piping and oil trap kit. 2. Remove the oil trap kit. 3. Remove the REPLACE MULTI ester oil kit. (Recover refrigerant inside the REPLACE MULTI ester oil kit.) 4. After reconnecting the piping kit (field work) to the outdoor unit, conduct evacuation. 5. Open the ball valve of the outdoor unit, and valve mounted to the extended pipe. [in the order of the extended piping to the outdoor unit (1) and (4)] ❇ After removing the REPLACE MULTI ester oil kit, confirm that ester oil does not flow out from the lower ball valve. ❇ After removing the oil trap kit, check the inner pressure. ❇ Store the kit at a place not exposed to direct solar radiation (sun light) in a cool and dark place.
Confirming the operation (compressor starting)	After recovering mineral oil, check the cooled (heated) air supply and compressor operating status by conducting normal air conditioning.

Conducting reflushing operation to improve mineral oil recovery conducts reflushing operation providing the PC screen below. Clicking [NG mode] initiates reflushing operation.



V. Mineral Oil Recovery Operation Data (Reference Data)

1. Standard data (During flushing operation)

Items \ Outdoor unit model name					PUHY-P200YREM-A	PUHY-P250YREM-A
Conditions	Ambient temp.	Indoor	(Dry bulb temp. /wet bulb temp.)	˚C	27/19	
		Outdoor			35/–	
	Indoor unit	Connected unit		Set	6	7
		Operating unit			6	7
		Model name		–	80/56x4/22	56x6/22
	Piping	Main piping		m	70	
		Branch piping			30/1	
		Total piping length			220	
	Refrigerant charge			kg	26.3	28.3
Outdoor unit	Current			A	29.7	35.1
	Voltage			V	200	
LEV opening	Indoor unit			Pulse	2000	
	SC (LEV1)				0	
	Oil return (SLEV)				64	
Pressure	High pressure (after O/S) /Low pressure (before MA)			MPa	2.35/0.48	
Sectional temperature	Outdoor unit	Discharge (TH1)		˚C	96	
		Heat exchanger outlet (TH5)			56	
		Low press. 2-phase temp. (TH2)			3.4	
		SC heat exchanger outlet (TH7)			54	
		Bypass outlet (TH8)			38	
	Composition detected value (α OC)				0.23	

Service, Maintenance / Inspection

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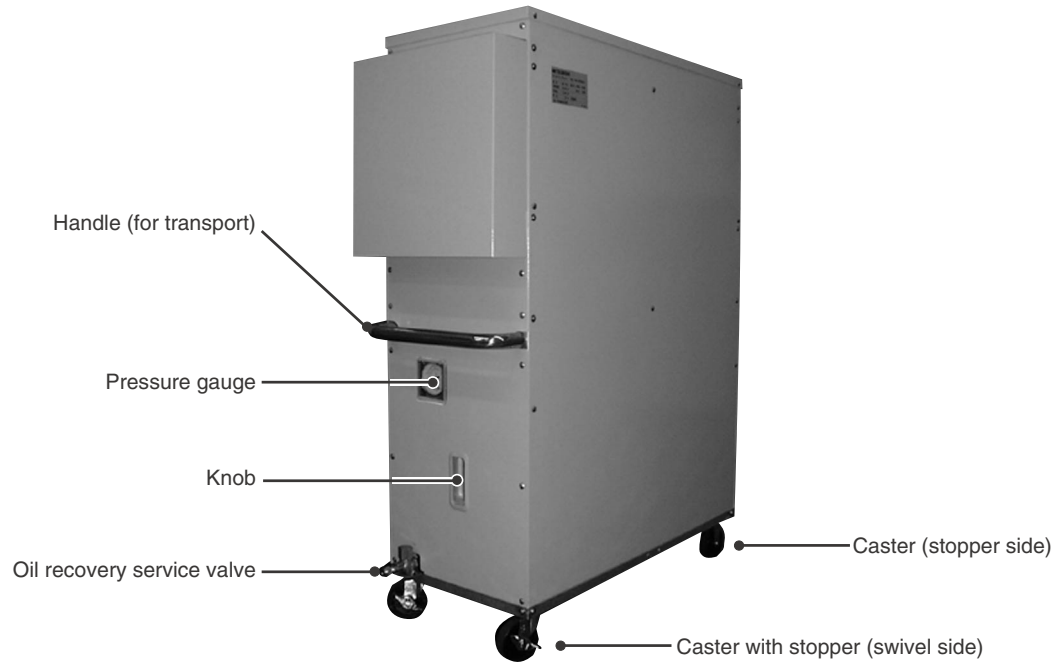
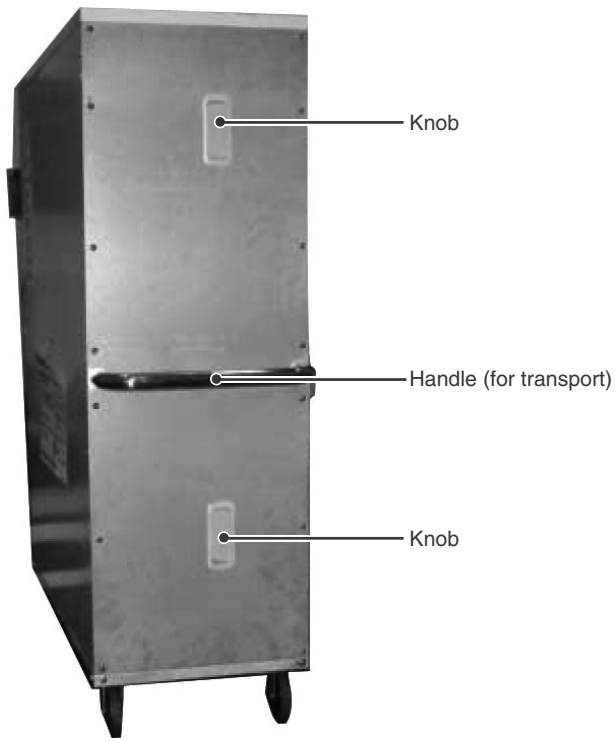
I. Construction of Oil Trap Kit

1. External appearance (with panel removed)

(1) Front view

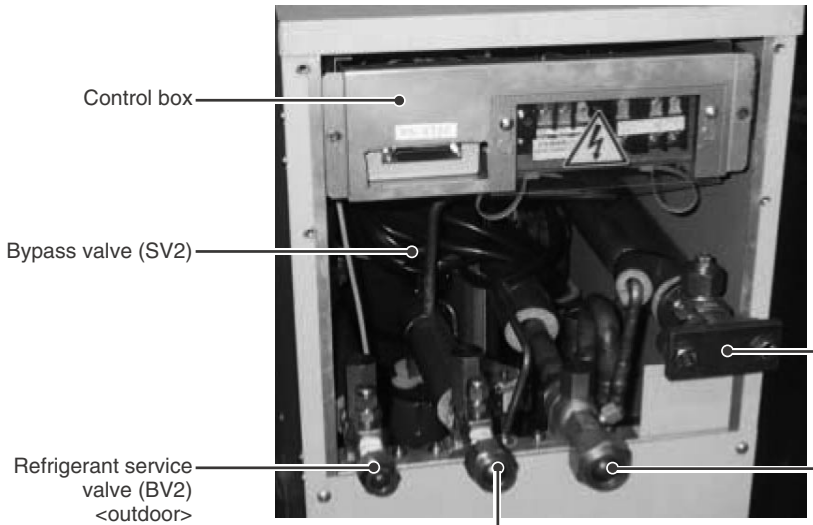


(2) Rear view

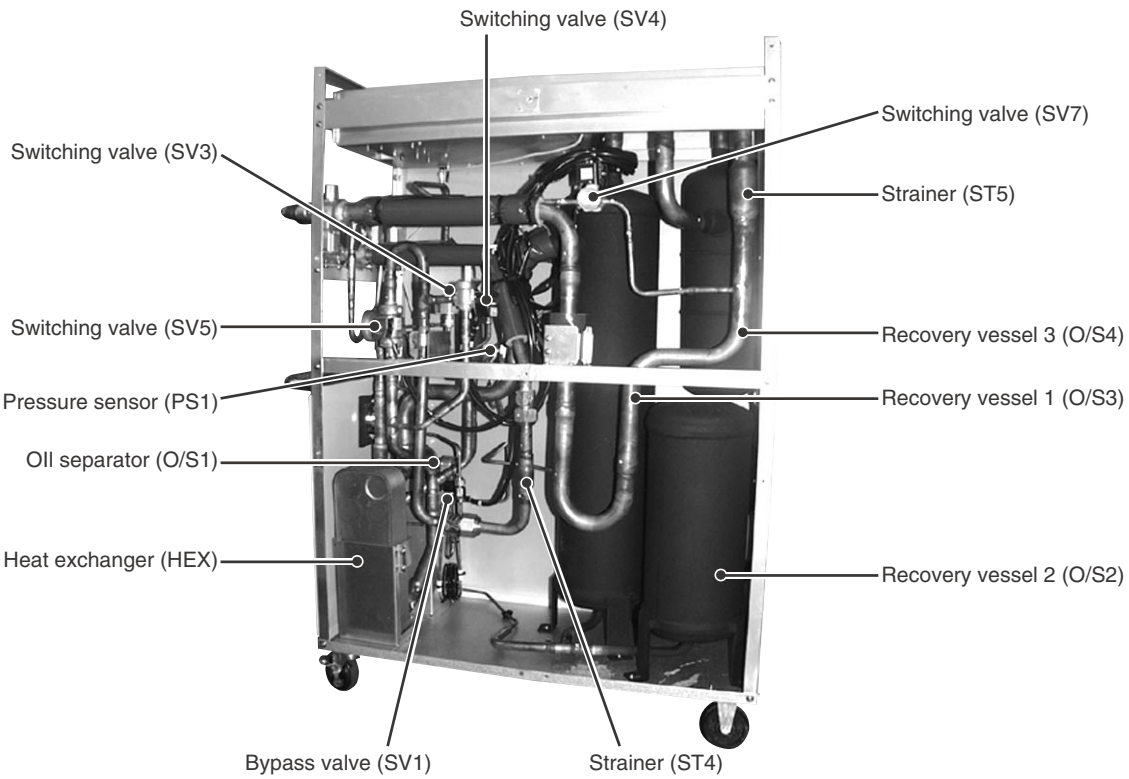


2. Refrigerant circuit

(1) Front view

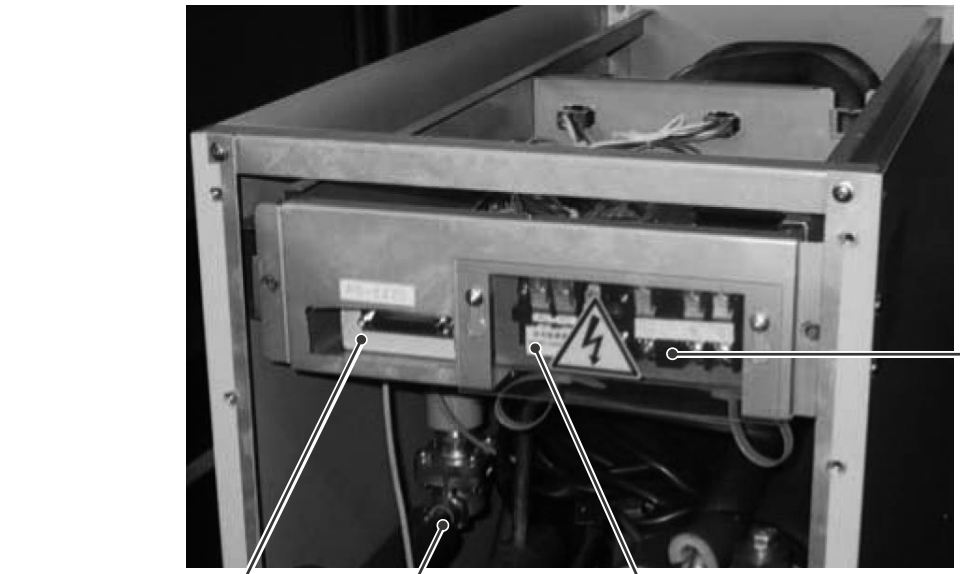


(2) Side view (The switching valve SV6 is indicated in 3. Control box.)

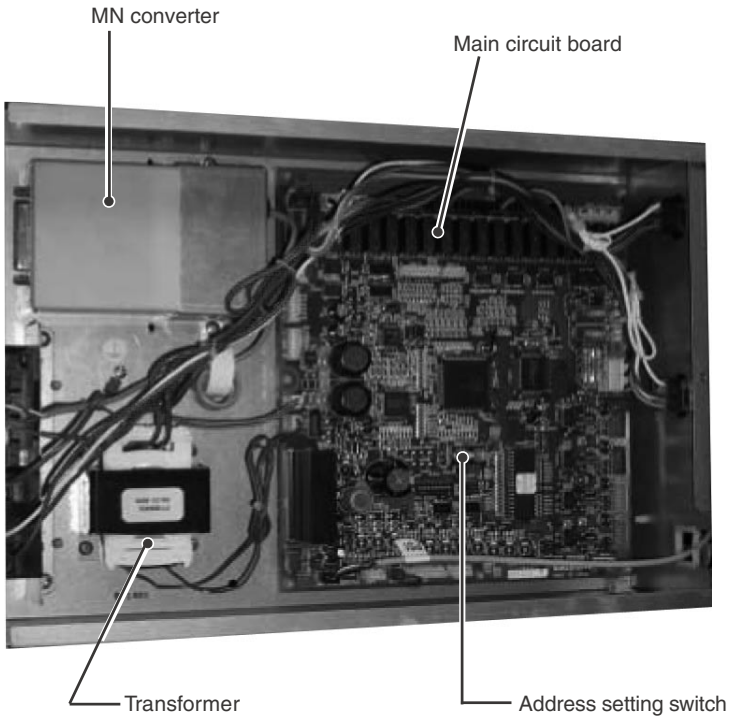


3. Control box

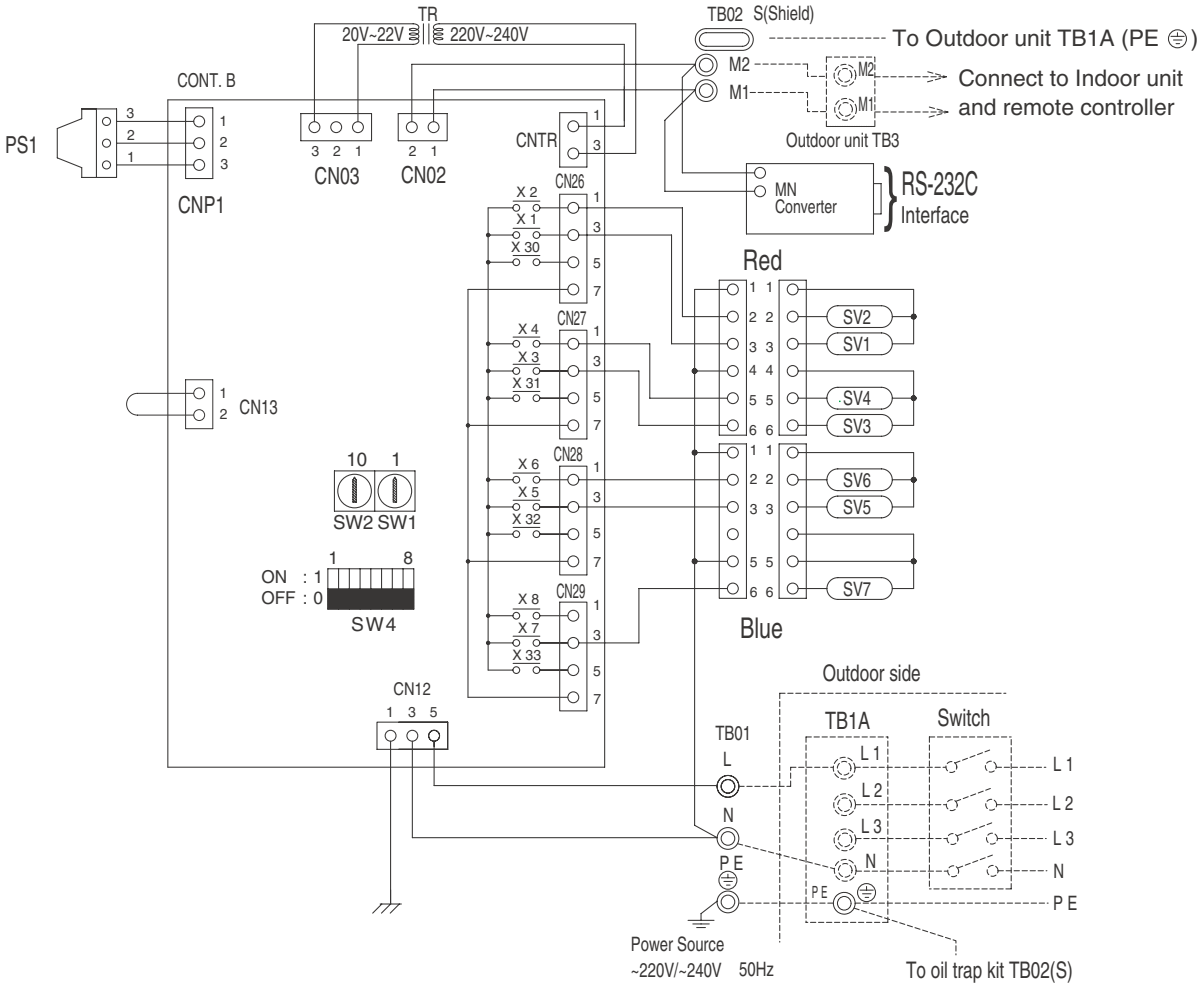
(1) Appearance


Power source terminal block (TB1)
Terminal for PC connection (RS-232C)
Switching valve (SV6)
Transmission terminal block (TB2)

(2) Upper side view



II. Electrical Wiring Diagram

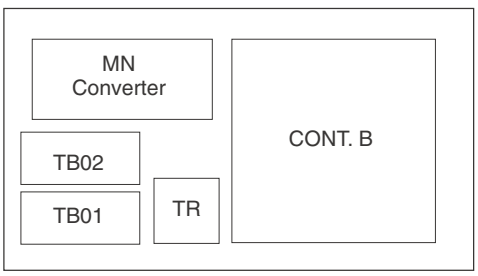


Notes: 1. TB02 is transmission terminal block. Never connect power line to it.
2. The install set values of switch on CONT.B are as follows.
SW1 : 0
SW2 : 0

Symbol explanation

Symbol	Name	
TR	Transformer	
PS1	Pressure sensor	
CONT. B	Circuit board	Oil trap kit
TB01	Terminal block (for power source)	
TB02	Terminal block (for transmission)	
SV1~7	Solenoid valve	

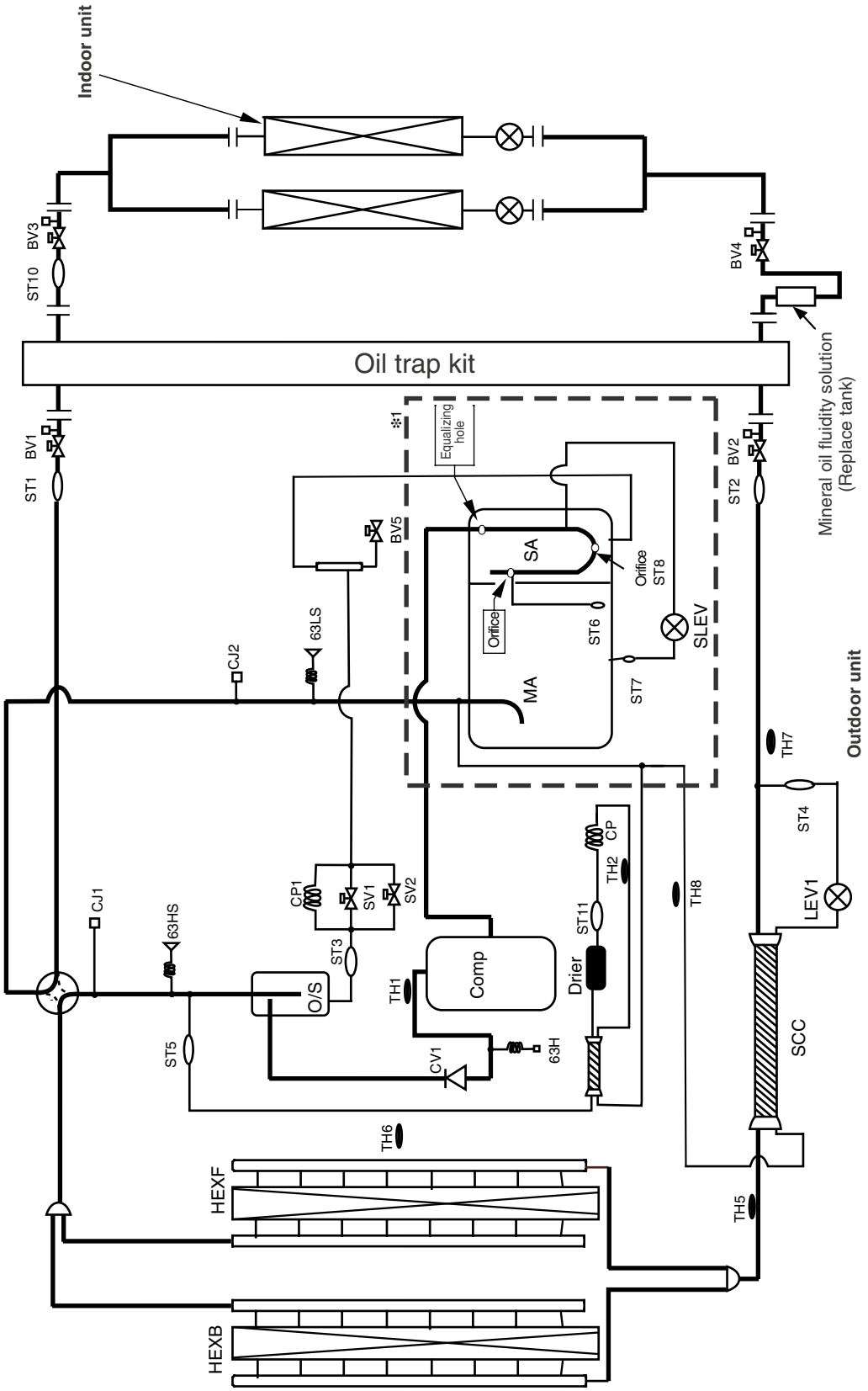
Box internal layout



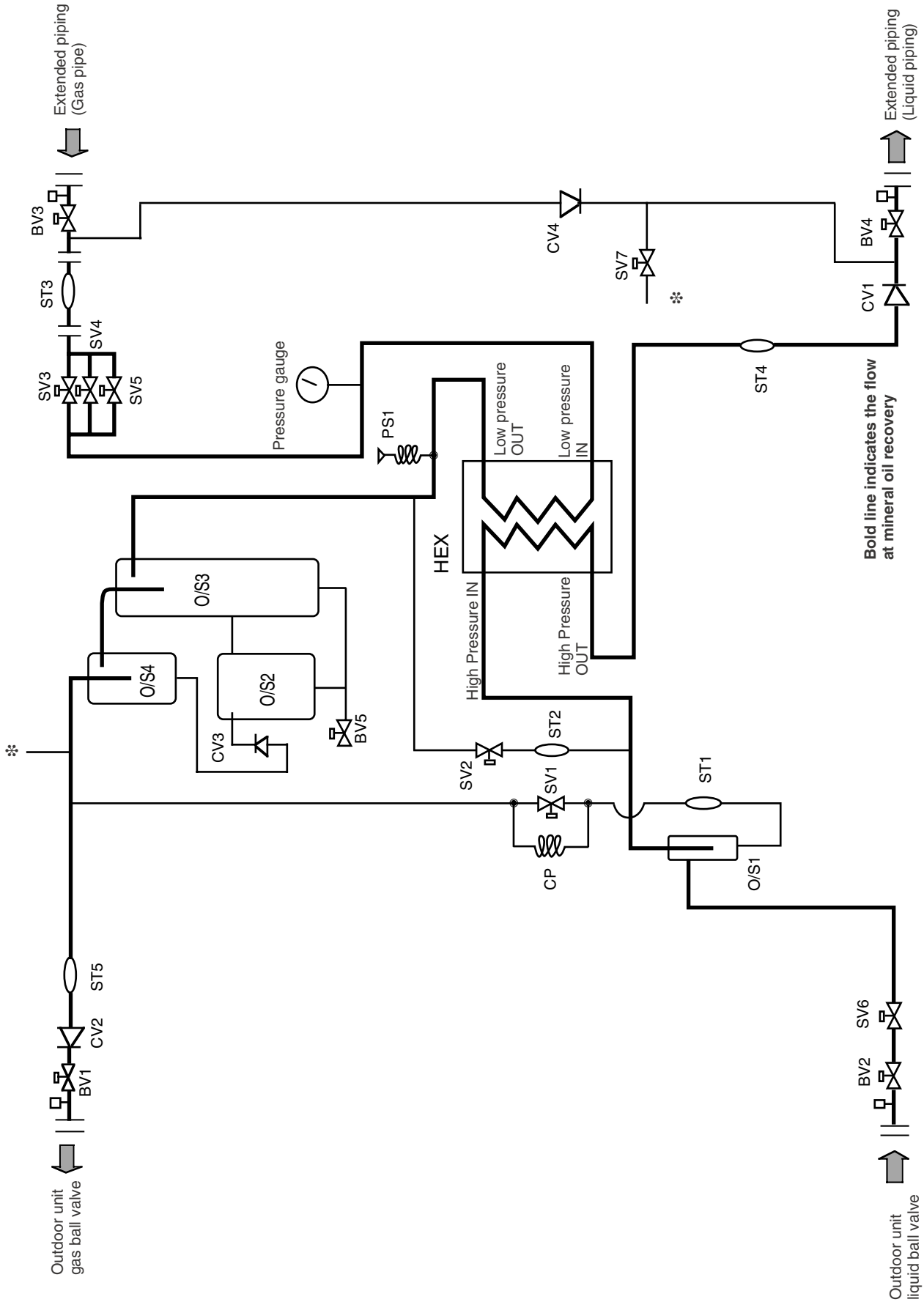
III. Refrigerant Circuit Diagram

1. Entire refrigerant circuit diagram at mineral oil recovery

[For Models PUHY-P200・P250]



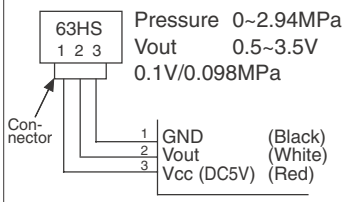
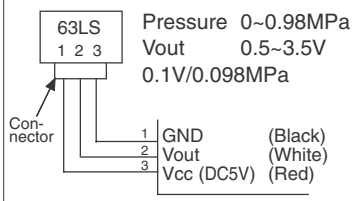
2. Refrigerant circuit diagram of oil trap kit



IV. Function List of Major Parts

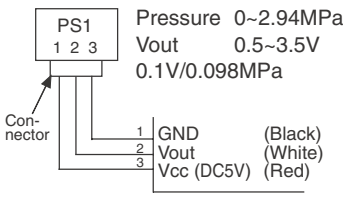
1. Outdoor unit

[For Models PUHY-P200・P250]

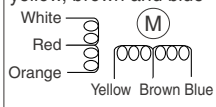
Name	Symbol (function)	Parts code	Application	Specification	Inspection method
Compressor	MC		Controls refrigerant circulation quantity by adjusting operating frequency with operating pressure	Low pressure shell scroll type Winding resistance : 0.583Ω (20˚C)	
High pressure sensor	63HS		(1) Detecting high pressure (2) Protecting high pressure		
Low pressure sensor	63LS		(1) Detecting low pressure (2) Calculating refrigerant circulating composition (3) Protecting low pressure		
Pressure switch	63H		(1) Detecting high pressure (2) Protecting high pressure	2.94MPa OFF setting	Checking continuity
Thermistor	TH1 (discharge)		(1) Detecting discharge temperature (2) Protecting high pressure	R_{120} = 7.465kΩ $R_{25/120}$ = 4057 R_t = $7.465\exp\{4057\,(\frac{1}{273+t}-\frac{1}{393})\}$ 20˚C 250kΩ 70˚C 34kΩ 30˚C 160kΩ 80˚C 24kΩ 40˚C 104kΩ 90˚C 17.5kΩ 50˚C 70kΩ 100˚C 13.0kΩ 60˚C 48kΩ 110˚C 9.8kΩ	Checking resistance value
	TH2		(1) Detecting saturated evaporating temperature (2) Calculating refrigerant circulating composition	R_0 = 33kΩ $B_{0/100}$ = 3963R R_t = $33\exp\{3963\,(\frac{1}{273+t}-\frac{1}{273})\}$ –20˚C 92kΩ 10˚C 20kΩ –10˚C 55kΩ 20˚C 13kΩ 0˚C 33kΩ 30˚C 8.2kΩ	Checking resistance value
	TH5 (piping temp.)		Detecting heat exchanger outlet temp.	R_0 = 15kΩ $B_{1/80}$ = 3460 R_t = $15\exp\{3460\,(\frac{1}{273+t}-\frac{1}{273})\}$ 0˚C 15kΩ 25˚C 5.3kΩ 10˚C 9.7kΩ 30˚C 4.3kΩ 20˚C 6.4kΩ 40˚C 3.1kΩ	Checking resistance value
	TH6 (OA temp.)		Detecting OA temp.		
	TH7		Detecting Scc liquid outlet temp.		
	TH8		Detecting Scc bypass outlet temp.		

Name	Symbol (function)	Parts code	Application	Specification	Inspection method
Thermistor (continued)	THHS (inverter radiator panel temp.)	Heat sink	Controlling inverter cooling fan by temp. of THHS	R_{50} = 17kΩ $B_{25/120}$ = 4170 R_t = $17\exp\{4170\,(\frac{1}{273+t}-\frac{1}{323})\}$ 0˚C 181kΩ 25˚C 50kΩ 10˚C 105kΩ 30˚C 40kΩ 20˚C 64kΩ 40˚C 26kΩ	Checking resistance value
Solenoid valve	SV1 (discharge–suction bypass)		(1) Returning oil at starting (2) Suppressing discharge pressure rise (3) Equalizing pressure at stopping	AC220~240V Opens at powering, closes at non-powering	Checking continuity with tester
	SV2 (discharge–suction bypass)		Bypassing of high/low pressure at starting/ under low pressure		
	SV3, 4		Control of heat exchanger capacity		
Electronic expansion valve	SLEV (oil return)		Adjusting liquid refrigerant (oil) returning from accumulator	Opening of DC12V stepping motor driving valve 0~480 pulses (direct driving)	Same as indoor LEV. But the resistance value differs from indoor LEV. (LEV refer to trouble-shooting)
	LEV1 (SC coil)		Adjusting bypass flow from outdoor unit liquid piping at cooling		
Heater	CH1 (crankcase heater)		Heating refrigerant inside compressor	Cord heater AC220~240V MC : 889Ω 45W	Checking resistance value
4-way valve	21S4		Switching cooling/heating cycles	AC220~240V Non-powered cooling cycle (mineral oil recovery) Powered heating cycle	Checking continuity with tester

2. Oil trap kit

Name	Symbol (function)	Parts code	Application	Specification	Inspection method
Pressure sensor	PS1		(1) Detecting high pressure		
Solenoid valve	SV1		(1) Returning oil at starting (2) Controlling refrigerant recovery	AC220~240V Opens at powering, closes at non-powering	Checking continuity with tester
	SV2		Bypassing of high/low pressure at starting/under low pressure		
	SV3 ~ 5		Controlling low pressure		
	SV6 SV7		Controlling refrigerant recovery		

3. Indoor unit

Name	Symbol (function)	Parts code	Application	Specification	Inspection method
Electronic expansion valve	LEV		Adjusting refrigerant at mineral oil recovery	DC12V Opening of stepping motor driving valve 0~2000 pulses	Refer to continuity check with tester Continuity between white, red and orange Continuity between yellow, brown and blue 
Thermistor	TH1 (inlet air temp.)		Detecting indoor air inlet temp.	R_0 = 15kΩ $B_{0/80}$ = 3460 $R_t = 15\exp\{3460\,(\frac{1}{273+t}-\frac{1}{273})\}$ 0˚C 15kΩ 30˚C 4.3kΩ 10˚C 9.7kΩ 40˚C 3.1kΩ 20˚C 6.4kΩ 25˚C 5.3kΩ	Checking resistance value
	TH2 (piping temp.)		Detecting indoor heat exchanger piping temp.		
	TH3 (gas piping temp.)		Detecting piping temp. at indoor heat exchanger gas side.		

V. Control of Mineral Oil Recovery Operation

1. Initial control

- At power-on, the initial processing of the micro computer is carried out above everything else.
- During the initial processing, control process for operation signal is sent and after the completion of the initial processing it starts.
  (Initial processing means data arrangement in the micro computer and the initial setting of each LEV opening and SV. The time required for the processing is about 3 minutes.)

2. Control of solenoid valves

The solenoid valves include the bypass valves between high pressure side and low pressure side (SV1, SV2), control of heat exchanger capacity valves (SV3, SV4), low pressure control valves (SV3~5), and refrigerant recovery control valves (SV6, 7), and these valves activate respectively as follows:

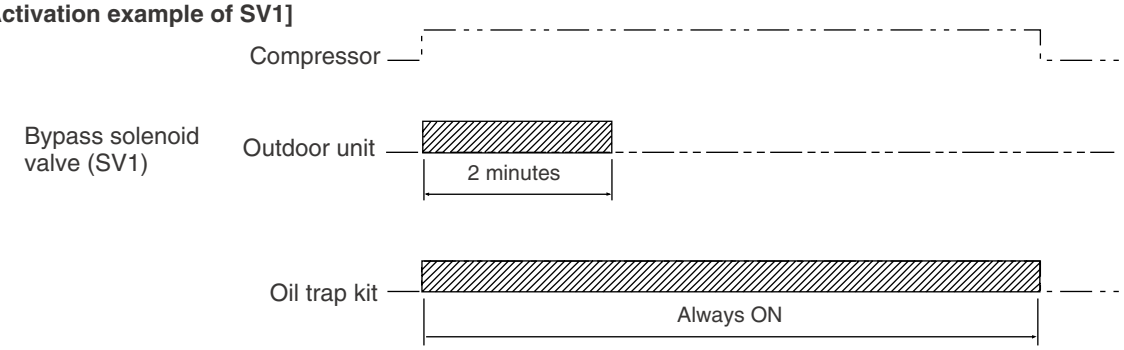
(1) The bypass solenoid valves (SV1, SV2) (All SV1, SV2 valves are opened in the ON position)

[For P200・250YREM-A]

Both the outdoor unit and oil trap kit are controlled in the same manner except for during recovery mode (During refrigerant recovery). The SV2 may be opened (ON) during NG mode according to the low pressure (63LS) of the outdoor unit.

Items		SV1	SV2
At the start-up of compressor		ON for 15 minutes	ON for 4 minutes (ON for 8 minutes when outdoor air temperature (TH6) is bellow 10˚C at the start-up of compressor.)
3 minutes after flushing mode (re-flushing) or recovery mode (recovery process)			
After shutdown		OFF	OFF
During recovery mode (Refrigerant recovery) (❇1)	Outdoor unit	ON for 2 minutes	OFF
	Oil trap kit	Always ON	OFF
During suspended recovery mode (Refrigerant recovery)	Outdoor unit	Always ON	Always ON
	Oil trap kit	OFF	OFF

❇1 **[Activation example of SV1]**



(2) Control of heat exchanger capacity valves (SV3, 4)
(All valves of SV3, 4 are opened in the ON position) : Outdoor unit

- SV3, 4 are opened. (Except for during a stop.)

(3) Low pressure control valves (SV3~5) (All valves of SV3~5 are opened in the ON position) : Oil trap kit

- The low pressure valves (SV3~5) are controlled so that the value may come close to the target value according to the value of the low pressure (63LS) of outdoor unit. (The valves are controlled every 30 sec.)
- At the start-up of compressor during flushing mode, only SV3 is opened.
- During recovery mode (Refrigerant recovery), all valves SV3~5 are closed.

(4) Refrigerant recovery control valves (SV6, 7) (All valves SV6 and 7 are opened in the ON position) : Oil trap kit

Items	SV6	SV7
During flushing mode (re-flushing)	Always ON	Always OFF
During recovery mode (refrigerant recovery)	Always OFF ❊1	Always ON ❊2

❊ 1. The SV6 is set to be opened until specified frequency reaches predetermined frequency.
❊ 2. When outdoor air temperature (TH6) is above +5˚C, the SV7 may be closed. (For P200 • 250YREM-A)

3. Frequency control

- Frequency varies so as to keep target refrigerant flow rate and operation characteristics constant.
- Variation of frequency is as shown below :

Models	Variation of frequency			Speed
	For 75 minutes after flushing mode starts ❊1 For 55 minutes after flushing mode starts ❊2 For 5 minutes after flushing mode starts ❊3	Except for the case described in the left	Recovery mode (Refrigerant recovery)	
Model P200	30 ~ 70Hz	30 ~ 70Hz	45[35]❊4 (30)❊5 Hz fixed	3Hz/Sec.
Model P250	30 ~ 80Hz	30 ~ 85Hz	45[35]❊4 (30)❊5 Hz fixed	

❊1 : When flushing time is 120 minutes
❊2 : When flushing time is 90 minutes
❊3 : When flushing time is 60 minutes
❊4 : At below 5˚C of outdoor air temperature (TH6)
❊5 : At below 5˚C of outdoor air temperature (TH6) :
When detecting low pressure (63LS) from shutdown to restart is 0.49MPa or less
When outdoor air temperature (TH6) is above 5˚C) :
When detecting low pressure (TH6) goes down to 0.12MPa or less or discharge temperature becomes abnormal
(Error code: 1102) within 1 minute.

(1) Frequency control at start-up

- The compressor operates at 30Hz for 5 minutes after compressor start-up during flushing mode.

(2) Limitation on discharge temperature

- When compressor discharge temperature (TH1) during flushing mode (reflushing) is detected to exceed its upper limitation of discharge temperature and the low pressure of outdoor unit is 0.441MPa or less, current operation frequency must be decreased by 5Hz.
(Discharge temperature is controlled every 30 seconds.)
- The activation temperature of this control is 105˚C.

(3) Limitation on high pressure

- When the high pressure (63HS) and low pressure (63LS) of outdoor unit during flushing mode (reflushing) are detected to exceed the upper limitation of each pressure, each current operation frequency will be decreased by 20Hz and 5Hz respectively. (Both pressures are controlled every 30 seconds.)
- The activation pressures are 2.548MPa (20Hz lowered) on the high pressure side and 2.352MPa (63LS< 0.392MPa) [5Hz decreased] at the low pressure side.

(4) Limitation on radiator panel

- When the radiator panel temperature (THHS) is detected to exceed 85˚C while the compressor operates, operation frequency must be decreased by 2Hz. (Temperature is controlled every 10 seconds.)

(5) Limitation on secondary current

- When secondary current is detected to exceed its upper limitation while the compressor is operating, operation frequency should be decreased by 2Hz. (Secondary current is controlled every 10 seconds.)
- The upper allowable current is as described below:
  Models P200 : 18Amps (25Apeak)
  Models P250 : 21Amps (29Apeak)

The ( ) in parentheses show approximate figures of bus current.

4. Oil return control (Electronic expansion valve <SLEV>)

As for oil return valve opening, SLEV is 64. However, when discharge temperature (TH1) exceeds 95˚C or more during recovery mode (Refrigeration recovery), SLEV is 200.
As for the valve opening while the compressor is shutdown, SLEV is 0.

5. Outdoor fan control

- The outdoor fan is controlled so that pressure value may come close to the target value according to the high pressure value (63HS) of the outdoor unit. (Pressure is controlled every 20 seconds.)
- The rise of discharge temperature (TH1) and high pressure (63HS) is controlled. (Discharge temperature is controlled every 30 seconds.)

(1) Outdoor fan control on start-up

- After the outdoor fan starts during flushing mode, the fan operates for 15 minutes according to outdoor air temperature (TH6) as shown right.

40 > TH6	Phase control
40 > TH6 ≥ 30	40%
30 > TH6 ≥ 20	30%
20 > TH6 ≥ 10	20%
10 > TH6	0%

- The phase on the start-up of outdoor fan during recovery mode (refrigerant recovery) is controlled as follows:

Outdoor unit	Outdoor air temperature (TH6)	Phase control
Model P250 or under	Below 5˚C	50%
	Above 5˚C	80%

- The outdoor fan stops while the compressor is stopped.
- However, the phase is controlled to be 100% for 1 minute during recovery mode (Refrigerant).

(2) Limitation on discharge temperature

- When discharge temperature (TH1) during flushing mode (reflushing) is detected to exceed its upper limitation temperature and that the low pressure (63LS) of the outdoor unit is 0.441MPa or more, the temperature and low pressure rise, causes 5% higher than normal current outdoor fan control. i.e. Fan speed up to lower high pressure.
- However, when discharge temperature (63HS) drops or keeps constant, outdoor fan control is not changed.
- The activation temperature is 105˚C.

(3) Limitation on high pressure

- When the high pressure (63HS) and low pressure (63LS) of outdoor unit during flushing mode (reflushing) are detected to exceed each of its upper limitation pressure, each pressure rises, causes by 20% higher than normal current outdoor fan control. i.e. Fan speeds up by drawing 20% more current.
- The activation pressure is 2.548MPa.
- When the high pressure (63HS) and low pressure (63LS) of outdoor unit during refrigerant recovery are detected to exceed each of its upper limitation pressure, each pressure rises, causes by 20% higher than normal current outdoor fan control. i.e. Fan speeds up by drawing 20% more current. This reduces high pressure.
- The activation pressure is 2.156Mpa.

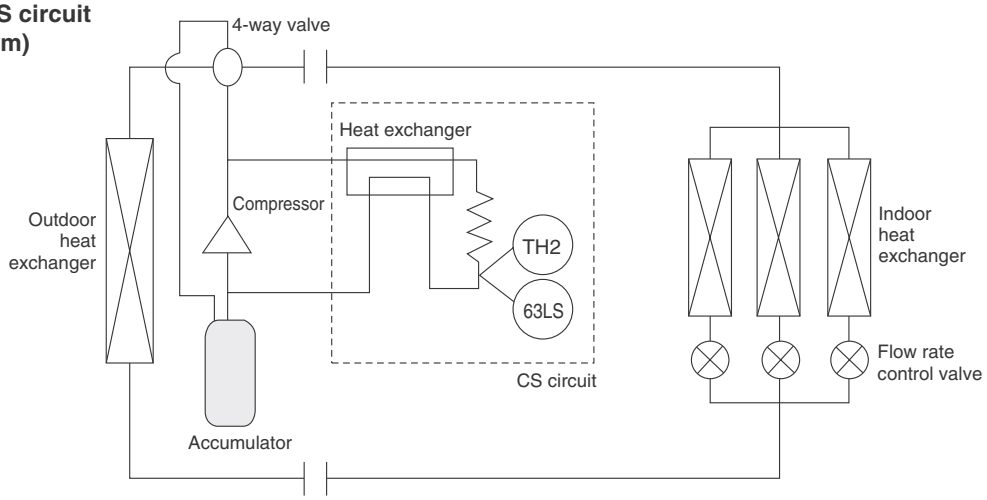
6. Sub-cooling coil control (Electronic expansion valve <LEV1>)

- As for valve opening during flushing mode (re-flushing), LEV1 is 80. However, when the high pressure (63HS) of outdoor unit exceeds 2.45MPa, LEV1 is 388.
- As for valve opening during recovery mode (pending), LEV1 is 388.

7. Detecting circulation composition (CS circuit)

- As shown in the figure below, CS circuit having a structure that bypasses a part of compressor discharge gas through the capillary tube to the heat-exchange. Assuming the refrigerant dryness fraction at the outlet of the capillary tube from both outdoor temperature (TH6) and the temperature (TH2)/pressure (63LS) of the low pressure gas/liquid 2-phase refrigerant, the refrigerant composition (αOC) circulating inside the refrigeration cycle is calculated. This method comes from a utilization of characteristics that the temperature of refrigerant R407C in gas liquid state varies together with composition and dryness (Mass ratio between gas and liquid) under a certain pressure.
- Condensing temperature (Tc) and evaporating temperature (Te) are calculated from the αOC, high pressure (63HS), and low pressure (63LS).
- The compressor frequency and outdoor fan are controlled by the condensing temperature (Tc) and evaporating temperature (Te).

Construction of CS circuit (Schematic diagram)



8. Distributed washing control and flow rate control (Indoor unit)

- The number of groups, when indoor units are automatically grouped allows regulating of the flow rate by use of the control valve (LEV) of indoor unit so that the remaining amount of oil in each branching tube may stabilize.
- The combination of the solenoid valve (SV) and flow rate control valve (LEV) during re-flushing mode is as shown below.

  Each valve is switched every 5 minutes, except for a period time of 15 minutes after having started flushing mode and a period time of 12 minutes just before finishing flushing mode. The switching-frequency of each valve during re-flushing mode varies in repetition according to the operation frequency of compressor and the low pressure (63LS) of outdoor unit.

	Flushing mode and recovery mode (recovery process)	Re-flushing mode and recovery mode (refrigerant recovery)
LEV (Indoor unit)	160 ~ 2000 ※1 / 150 Pulse ※2	160 ~ 2000 Pulse ※1

※1. The minimum valve opening varies according to the number of indoor unit in each group.
※2 . At the time of non-distributed flushing mode

9. Indoor unit fan control

- During mineral oil recovery, the indoor unit fan operates intermittently at the time of the following operation:
  (1) For 5 seconds after having started mineral oil recovery
  (2) During non-distributed flushing mode (LEV=150)
  (3) While the oil trap kit SV1 during re-flushing and recovery modes are in the state of ON, except for 15 minutes after having started mineral oil recovery

VI. Operation Flow Chart

1. Flushing operation

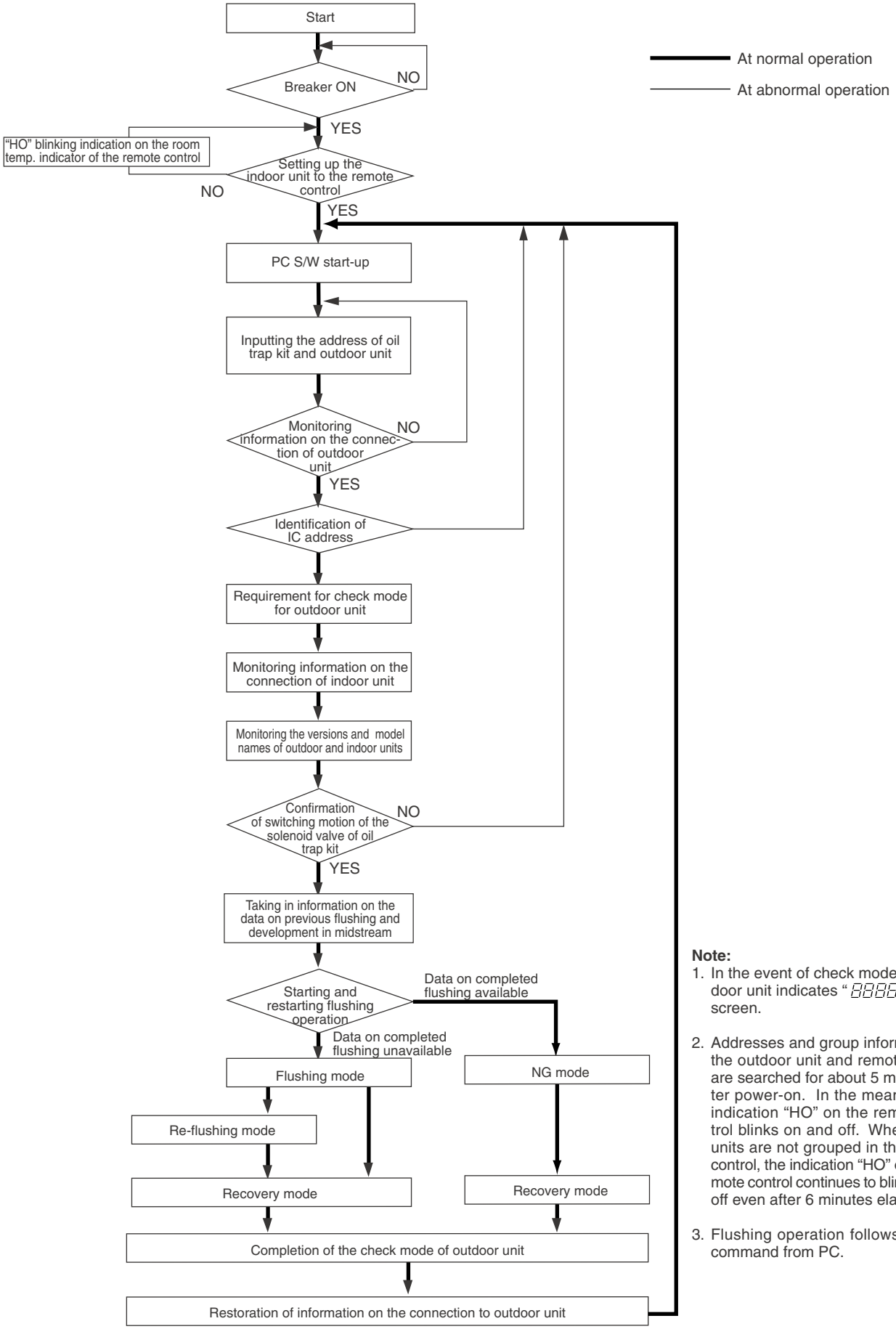
At the time of flushing operation, the following 4 kinds of modes are available.

(1) Flushing mode	Oil recovery in the existing pipes
(2) Re-flushing mode	Carried out when the target flow rate fails to be achieved in (1) Flushing mode.
(3) Recovery mode	Refrigerant recovery in the oil trap kit
(4) NG mode	Dilution of concentrated mineral oil in ester oil

Note: Above (4) NG mode is available only when mineral oil recovery operation is completed.

2. Flow chart of flushing operation

Mode determination flow


Start
Breaker ON
NO
YES
"HO" blinking indication on the room temp. indicator of the remote control
Setting up the indoor unit to the remote control
NO
YES
PC S/W start-up
Inputting the address of oil trap kit and outdoor unit
Monitoring information on the connection of outdoor unit
NO
YES
Identification of IC address
Requirement for check mode for outdoor unit
Monitoring information on the connection of indoor unit
Monitoring the versions and model names of outdoor and indoor units
Confirmation of switching motion of the solenoid valve of oil trap kit
NO
YES
Taking in information on the data on previous flushing and development in midstream
Starting and restarting flushing operation
Data on completed flushing available
Data on completed flushing unavailable
Flushing mode
NG mode
Re-flushing mode
Recovery mode
Recovery mode
Completion of the check mode of outdoor unit
Restoration of information on the connection to outdoor unit
At normal operation
At abnormal operation

Note:

1. In the event of check mode, the outdoor unit indicates " 8888 " on the screen.
2. Addresses and group information of the outdoor unit and remote control are searched for about 5 minutes after power-on. In the meantime, an indication "HO" on the remote control blinks on and off. When indoor units are not grouped in the remote control, the indication "HO" on the remote control continues to blink on and off even after 6 minutes elapses.
3. Flushing operation follows a mode command from PC.

VII. Troubleshooting

1. List of checking code

Check code		Check content	
0403		Serial transmission abnormality	
0900		Test run (ventilation)	
1102		Discharge temperature abnormality	
1111		Low pressure saturation temperature sensor abnormality (TH2)	
1301		Low pressure abnormality (OC)	
1302		High pressure abnormality (OC)	
1500		Overcharged refrigerant abnormality	
2500		Leakage (water) abnormality	
2502		Drain pump abnormality	
2503		Drain sensor abnormality	
2600		Abnormal water leak	
4103		Reverse phase abnormality	
4106		Detection of electric power failure/electric instantaneous power failure	
4115		Power supply sync signal abnormality	
4116		Fan speed abnormality (motor abnormality)	
4200		VDC sensor/circuit abnormality	
4220	[108]	Bus Voltage drop abnormality (S/W detect)	
	[109]	Bus Voltage rise abnormality (S/W detect)	
	[110]	Vdc abnormality (H/W detect)	
	[111]	Logic circuit for H/W error detect abnormality	
4230		Heat sink overheating abnormality	
4240		Overload abnormality	
4250	[101]	IPM abnormality	
	[102]	ACCT overcurrent abnormality (H/W peak detect)	
	[103]	DCCT overcurrent abnormality (H/W peak detect)	
	[104]	IPM short/grounding abnormality	
	[105]	Load short abnormality	
	[106]	ACCT overcurrent abnormality (S/W detect peak current)	
	[107]	ACCT overcurrent abnormality (S/W detect effective current)	
4260		Cooling fan abnormality	
5301	[115]	IAC sensor abnormality	
	[116]	IDC sensor abnormality	
	[117]	IAC sensor/circuit abnormality	
	[118]	IDC sensor/circuit abnormality	
	[119]	IPM-open/ACCT connection abnormality	
	[120]	ACCT miss-wiring abnormality	
5101		Thermal sensor abnormality	Air inlet (TH21:IC), Lossnay inlet (TH4) Discharge (TH1:OC)
5102			Liquid pipe (TH22:IC), Lossnay pipe (TH2) Low pressure saturation (TH2:OC), Lossnay gas side pipe (TH3)
5103			Gas pipe (TH23:IC)
5104			Accumulator liquid level (LD2)
5105			Liquid pipe (TH5)
5106			Ambient temperature (TH6)
5107			SC coil outlet (TH7)
5108			SC coil bypass outlet (TH8)
5110			Heat sink (THHS)
5111			Fan controller radiator panel (TH BOX)

[ ] : Error detail No.

Check code	Check content
5201	Pressure sensor abnormality (OC)
5301	IAC sensor/circuit abnormality
6500	Abnormal communication, abnormal setting, and abnormal transmission
6600	Multiple address abnormality
6601	Communication error – Polarity unsettled
6602	Transmission processor hardware abnormality
6603	Transmission circuit bus-busy abnormality
6606	Communications with transmission processor abnormality
6607	No ACK abnormality
6608	No response abnormality
6831	MA Communication no reception error
6832	MA Communication synchronization recovery error
6833	MA Communication transmission/reception hardware error
6834	MA Communication start bit error
7100	Total capacity abnormality
7101	Capacity code abnormality
7102	Connected unit count over
7105	Address setting abnormality
7106	Characteristics setting abnormality
7107	Connection number setting abnormality
7111	Remote control sensor abnormality
7113	Functional restriction error
7130	Different unit model error

2. Self-diagnosis and countermeasure for malfunction and failure indicated by PC

(1) Mechanical system

Check codes		Meaning/Detection means	Trouble factors	Checking method and countermeasure
0403	Serial transmission abnormality	If serial transmission cannot be established between the MAIN and INV boards.	1) Wiring is defective.	Check 1, the connections, 2, contact at the connectors and 3, for broken wires in the following wiring. CNRS2 - CNRS3 CNAC2 - TB1B
			2) Switches are set wrong on the INV board.	SW1-4 on the INV board should be OFF.
			3) The fuse (F01) on the INV board is defective.	If the fuse is melted, (if the resistance between the both ends of fuse is ∞), replace the fuse.
			4) The circuit board is defective.	If none of the items in 1) to 3) is applicable, and if the trouble reappears even after the power is switched on again, replace the circuit board by the following procedure (when replacing the circuit board, be sure to connect all the connectors, ground wires, etc. securely). a) If serial transmission is restored after the INV board only is replaced, then the INV board is defective. b) If serial transmission is not restored, reinstall the INV board and replace the MAIN board. If serial transmission is restored, the MAIN board is defective. c) If serial transmission is not restored by a) and b) above, replace both boards.
1102	Abnormal discharge temperature	(1) When discharge temperature is detected to exceed 120˚C during operation, the unit stops operation. At this moment, a failure no.1102 is displayed on the screen.	1) Gas leak and gas shortage	Confirmation of refrigerant quantity.
			2) Overload operation	Confirmation of operation conditions and operating status of indoor and outdoor units.
			3) Malfunctioning operation of ball valve	Confirmation of the ball valve being fully opened.
			4) Outdoor fan block, motor failure, and actuation failure of fan controller [The above 3) results in non-control of discharge temperature rise due to pulling in low pressure air and the above 4) results in non-control of discharge temperature rise.]	Checking of the outdoor fan. Refer to the page for the failure determination of outdoor fan. (VII-4-3)
			5) Gas leak between high pressure part and low pressure part (Malfunction in 4-way valve, compressor failure, and malfunction in outdoor solenoid valves SV1 and SV2)	Confirmation of operating status by performing flushing operation.
			6) Malfunction in thermistor (TH1)	Confirmation of the resistance of thermistor. (IV-1)
			7) Input circuit error for thermistors on the control board	Confirmation of the inlet temperature to the sensor with the PC monitor.
1301	Abnormal low pressure	In the case of starting compressor first from stop mode, including the time when the compressor starts next time, at the time of starting compressor at the beginning and ending of a constraint on power distribution, when the low pressure sensor indicates 0.098MPa just before compressor starts to operate, the compressor must be stopped immediately.	1) Inner pressure drop due to gas leak 2) Malfunction in low pressure sensor 3) Insulation wreckage 4) Disconnection off of pin at connecting parts 5) Breaking of wire 6) Input circuit error for the low pressure of control board	Refer to the page for the failure determination of low pressure sensor. (VII-4-1)

Check codes		Meaning/Detection means	Trouble factors	Checking method and countermeasure
1302	Abnormal high pressure 1 (Outdoor unit)	(1) When the pressure sensor detects in excess of 2.94MPa during operation, the compressor stops. At this moment, a failure no.1302 is displayed on the screen. (2) Apart form the pressure sensor, when the pressure relay actuates at 2.94± MPa, the compressor stops.	1) Malfunction of indoor LEV→ Heating	Confirmation of operating status by performing flushing operation. Refer to the page for the failure determination of LEV. (VII-4-4)
			2) Operation failure in the ball valve	Confirmation of the ball valve being fully opened.
			3) Outdoor fan block, motor failure, and actuation failure of fan controller (Non-control of high pressure rise by the use of fan)	Checking of the outdoor fan. Refer to the page for the failure determination of outdoor fan. (VII-4-3)
			4) Pressure sensor failure	Refer to the page for the failure determination of pressure sensor. (VII-4-1)
			5) Input circuit error for the thermistor on the main board and pressure sensor	Confirmation of the inlet temperature and pressure to the sensor by PC monitor.
			6) Slipping off of the connecter for pressure relay (63H) and disconnection	Confirmation of the inlet temperature and pressure to the sensor by PC monitor
			21) Blown fuses (F1 or F2) on the control board	Confirmation of the blown fuse. Confirmation unless the actuators of cooling fans (MF), 4-way valves, and solenoid valves are short-circuited.
1500	Overcharged refrigerant abnormality	(1) If the discharge SH≤10K is detected during operation (at first detection), the outdoor unit stops at once. The 3 minutes restart prevention mode is entered. After three 3 minutes, the outdoor unit starts up again. (2) If the discharge SH≤10K is detected again within 30 minutes after the out door unit stops (second detection), an abnormal stops is applied, and "1500" is displayed. (3) If discharge SH≤10K is detected more than 30 minutes after the outdoor unit stops, the state is the same as the first detection and the same operation as 1 above takes place. (4) The abnormal stop delay period is in effect for 30 minutes after the outdoor unit stops. The abnormal stop delay period LED turns ON during this time. (5) If the abnormality detection prohibit switch (SW2-4) is ON, the same operation as the first detection will apply for the second and following detections.	1) Excessive refrigerant charge.	Refer to the section on judging the refrigerant volume.
			2) Main circuit board thermistor input circuit trouble	Check the sensor detection temperature and pressure with the LED monitor.
			3) Thermistor mouting trouble (TH1, TH2)	
2500	Abnormal water leak	When the drain sensor detects submersion under water while the drain pump is shutdown	1) Water leak due to the trouble of humidifier	Check if water leak around the humidifier and clogged drain of the drain.
2502	Drain pump failure	When the indirect heater of the drain sensor is turned on and the temperature rise from the temperature detected before power-on to the indirect heater is within 20K in the water for 40 seconds, or the drain sensor is covered with water when the temperature of the drain sensor is 63˚C or less after 40 seconds, and then the drain sensor detects submersion under water 3 minutes later at the shortest after the drain pump is turned on.	1) The drain sensor is covered with water due to the rise of water level caused from a trouble of the drain-up mechanism 2) The indirect heater of the drain sensor is disconnected 3) Detection circuit (board) failure 4) Trouble in the LEV of indoor unit	Confirmation of the operation of the drain pump. Measurement of the resistance of indirect heater for the drain sensor. (82Ω at a normal condition between 1 and 3 of CN50) If no failure is found with the drain pump, it is an indoor board failure. Confirm that TH2 and TH3 temperature rise nearly to room temperature when the fan operation of indoor unit operates.

Check codes		Meaning/Detection means	Trouble factors	Checking method and countermeasure
2503	Drain sensor failure	When Short/Open is detected during operation (During shutdown nothing is detected.) Short : Detection above 90˚C Open : Detection under –40˚C	1) Thermistor failure 2) Contact failure of the connecter (Insufficient insert) 3) Disconnection or semi-disconnection of wiring for the thermistor	Checking of the resistance value of the thermistor 0˚C : 15kΩ 30˚C : 4.3kΩ 10˚C : 9.7kΩ 40˚C : 3.1kΩ 20˚C : 6.4kΩ
			4) Indoor board (Detection circuit) failure	Checking of the contacts of the connecter. If no problem is found, it is an indoor board failure.
2600	Abnormal water leak	–	Water leak from the pipes for the humidifier and other equipment	Confirmation of water leak points
2601	Abnormal water supply cut	–	1) Water is not supplied to the water tank for the humidifier 2) The solenoid valve for the humidifier is not powered	Confirmation of water supply quantity. Checking of the solenoid valve and connection. Confirmation of connecter parts.
			3) The float switch is disconnected	Confirmation of connecting part.
			4) The float switch is out of work	Float switch failure.
			5) The water in the water supply tank is frozen	After power source is once turned off, power is turned on after deicing.
4103	Abnormal negative phase and open phase	(1) The unit does not operate due to the negative phase in power sources (L_1, L_2, L_3,).	1) Wiring failure	Check if the phase of power source terminal block TB1 is positive. Checking of wiring from the power source terminal block TB1 to the board CN20 TB1 – CN20 L_1 – 7-pin L_2 – 5-pin L_3 – 3-pin
			2) Main board failure	• When no failure is found with the above, it is a main board failure.
		(2) The unit does not operate due to the open phase of any in power sources (L_1, L_2, L_3, N).	1) Power source failure a. Negative phase in power source voltage b. Power source voltage drop	• Checking of the input voltage of the power source terminal block TB1
			2) Abnormal wiring a. Between the voltage terminal block and the main board CN20	• Checking of the voltage among pins 3, 5 and 7 of the main board connecter CN20. If the voltage is less than power source voltage –10% (V), it is a wiring failure.
			b. Between the high pressure relay 63H and the main board CN38	• Confirm if the main board connecter CN38 is not slipped off. • Confirm if the wiring to CN38 is not open.
			3) The fuse for the main board is broken.	• Confirm if the main board fuses F01 and F02 are not broken.
			4) The main board failure	• If no problem is found, it is a main board failure.
4106	Power failure Instantaneous power stopping	(1) The unit can not operate due to electric power failure/instantaneous stopping of electric power	1) Power source environment	• Confirmation of generation of electric power failure/instantaneous stopping of electric power at the time when any trouble is detected. Confirm if inter phase power source voltage is power source voltage –10% (V) or more.

Check codes		Meaning/Detection means	Trouble factors	Checking method and countermeasure
4115	Abnormal power source synchronized signal	(1) At power-on, power frequency can not be determined. (Detection of power frequency is impossible. The outdoor fan can not be controlled by phase control.)	1) Power source failure	• Check the voltage of the terminal block for power source TB1.
			2) Breaking of the fuse for the main board	• Check the main board fuses F1 and F2.
			3) Wiring failure	• Check the voltage among pins 1, 5, and 7 of the main board connecter CN20. Unless it is the same voltage as power source voltage (AC380/400/415V), it is a wiring failure.
			4) Main board failure	❇Despite that all of the above items are normal, if any problem still remains, it is a main board failure.
4116	Abnormal fan revolution	(Only PKFY-AM is detected.) (1) When the fan revolution is detected to be 180 rpm or less, or 2,000rpm or more in the first detection while the fan of indoor unit is operating, 3-minute-restart prohibition mode is applied to stop the fan for 30 seconds. (2) After the fan restarts 30 seconds after stopping, when the fan revolution is detected to reach 180 rpm or less, or 2,000 rpm or more, the unit operation stops irregularly, including the fan. At this moment, an error "4116" is displayed on the screen.	1) The revolution-detection connecter for the indoor control board (CN33) is slipped off.	• Confirm if the connecter for the indoor controller board (CN33) is not slipped off.
			2) The connecter for fan output of the indoor power board (FAN1) is slipped off.	• Confirm if the connecter for the indoor power board (FAN1) is not slipped off.
			3) The wiring of the revolution-detection connecter for the indoor control board (CN33) is broken, or the connecter for fan output of the indoor power board (FAN1) is disconnected.	• Confirm if the wiring is not broken.
			4) The filter is clogged	• Check the filter.
			5) Indoor fan motor failure	• Check the indoor fan motor.
			6) The revolution-detection circuit error for the indoor controller board or the output circuit error for the indoor power board.	• If no problem is found with those above, a) In the case that the fan is out of work after starting operation, replace the indoor controller board. When the fan does not still operate properly after the replacement of the board, replace the power board as well. b) In the case that the fan does not operate, replace the indoor power board.
	Motor failure	(Only Losnay is detected.) (1) The motor is rotating in the state of OFF. (2) The thermal relay is in the state of ON. (Only for 3-phase model)	1) Board failure	• Replace the board.
			2) Motor failure 3) Electromagnetic switch failure	• Check the motor and electromagnetic switch.

<table>
<tr><th colspan="2">Check codes</th><th>Meaning/Detection means</th><th>Trouble factors</th><th>Checking method and treatme</th></tr>
<tr><td>4121</td><td>Malfunction in counter-measure device for higher harmonics wave</td><td>Abnormal communication with Active filter (PAC-KB51AAC)</td><td>1) For equipment without connecting Active filter, the connecting switch to Active filter is in the ON position.</td><td>• Switch the connecting switch to Active filter for outdoor unit (Dip switch SW3-8 on the outdoor control board) to the OFF position.</td></tr>
<tr><td></td><td></td><td></td><td>2) Wiring failure</td><td>• Confirm if the power source wire is connected to the terminal block for power source for outdoor unit.
• Check the main board connecter CN51, the wiring between CN3S(3D) and Active filter, and the contact point at connecting parts.</td></tr>
<tr><td></td><td></td><td></td><td>3) Active filter failure
<table><tr><th>Failure detection of Active filter (LED indication)</th><th>Failure contents</th></tr><tr><td>OC (LED3) lighting</td><td>Over current (Peak 60A or more)</td></tr><tr><td>OC (LED3) blinking</td><td>Slipping off of ACCT connecter (AF board–CN4)</td></tr><tr><td>OV (LED4) lighting</td><td>Direct current bus over voltage (410V or more)/ voltage shortage (300V or less during operation)</td></tr><tr><td>OH (LED5) lighting</td><td>Heating (Heat sink thermostat actuates at 100˚C</td></tr><tr><td>All lighting</td><td>Instantaneous stopping of electric power/ electric power failure, open phase, power source voltage increase/decrease</td></tr><tr><td>All blinking</td><td>Actuation of heat sink thermostat just before starting, instantaneous stopping of electric power/electric power failure, open phase, power source voltage increase/decrease, intermittent fault check.</td></tr></table></td><td>• Check the detailed contents of LED3 to 5 on the Active filter board.
❇ At the overhauling of Active filter, be sure to wait for 10 minutes or more after powering off, and confirm the CHARGE (LED1) is being off and the charged voltage of the main capacitor is being sufficiently low to proceed work further.
❇ As for checking method and treatment of Active filter failure, refer to Active Filter Service Handbook which is separately distributed or Active Filter Installation and Instruction Manual which is attached to Active filter.</td></tr>
<tr><td>4220</td><td>Bus voltage drop protection
(Failure details No.108)</td><td>When detecting Vdc is150V or less while the inverter is operating</td><td>1) Power source environment</td><td>Check if there are instantaneous stopping of electric power, power failure, etc. when a failure is detected. Check if each interphase voltage is power source voltage –10% (V) or more.</td></tr>
<tr><td></td><td></td><td></td><td>2) Detection voltage drop</td><td>Confirmation of voltage between G/A board FNO1 and 2.
→ If the voltage drops, go to (3).
Check the voltage at the part of the G/A board CNDC1.
→ If the voltage drops, replace the G/A board.
Check the voltage at the part of the INV board connecter CNDC2.
→ If the voltage drops, it is a wire-connecting failure.
Check soldering at the part of the INV board connecter CNDC2.</td></tr>
<tr><td></td><td></td><td></td><td>3) INV board failure</td><td>Confirm if DC12V is applied to the inverter board connecter CN52C while the inverter is working.</td></tr>
<tr><td></td><td></td><td></td><td>4) 52C failure</td><td>Refer to VII-5-(4)
“Checking of coil 52C resistance”
Check the voltage between 52C contact points while the inverter is operating.</td></tr>
<tr><td></td><td></td><td></td><td>5) Diode stack failure</td><td>Refer to VII-5-(6)
Checking of Diode stack resistance.</td></tr>
</table>

Check codes		Meaning/Detection means	Trouble factors	Checking method and countermeasure
4220	Bus voltage increase protection (Failure details No.109)	When detecting Vdc is 425V or more while the inverter is working.	1) Different voltage connection	Confirmation of power source voltage at the power terminal block (TB1)
			2) INV board failure	If no problem is found with power source, replace the INV board.
	VDC failure (Failure details No.110)	Abnormal bus voltage. When detecting Vdc is 400V or more, or 160V or less.	1) Details No.4220: Same as No.108 and 109	Failure details No.4220: Same as No.108 and 109
	Logic failure (Failure details No.111)	Abnormal H/W logic. When only the circuit is alive without any detection of failure discrimination.	1) External noise	Refer to VII-3. "Malfunction by external noise"
			2) Inverter board failure	If detecting the same failure even after restart, replace the inverter board.
4230	Heat sink overheat protection	When detecting the cooling fan is continuously running for 5 minutes or more and at the same time heat sink temperature (THHS) exceeds 95˚C while the inverter is working.	1) Power source environment	Confirmation of power source voltage. Make sure each inter phase power voltage is 180V or more.
			2) Clog in air trunk	Check if clog is found in the cooling air trunk for the heat sink.
			3) Wiring failure	Checking of wiring for the cooling fan.
			4) THHS failure	Checking of THHS sensor resistance.
			5) Output failure in the INV board fan	Confirm if heat sink temperature is 55˚C or more and 200V is applied to the inverter board connecter CNFAN while the inverter is working.
			6) Cooling fan failure	Confirmation of the cooling fan operation under the above running condition.
			7) IPM error	Refer to (VII-5-(2)) [2] Checking of compressor earth fault and winding wire failure [5] Checking of inverter circuit trouble
4240	Overload protection	When output current (Iac) is over. Imax (Amps) or THHS is 85˚C or more for consecutive 10 minutes while the inverter is working. For model P140, P160, P244, Imax = 35Amps For model P280 and P450, Imax is = 41Amps For model P355, P500, P560, Imax is = 50Amps	1) Air trunk short cycle	Check if the exhaust air of unit fan is not short-circuited.
			2) Clog in air trunk	Check if the heat sink air trunk is not found clogged.
			3) Power source	Make sure power source voltage is 180V or more.
			4) Wiring failure	Checking of cooling fan wiring
			5) THHS failure	Checking of THHS sensor resistance
			6) Output failure in the INV board fan	Check if heat sink temperature is 55˚C or more and 200V is applied to the inverter board connecter CNFAN while the inverter is working.
			7) Cooling fan failure	Confirmation of the operation of the cooling fan under the above running condition.
			8) Current sensor (ACCT) failure	Refer to (VII-5-(4)) "Current sensor ACCT"
			9) Inverter circuit error	Refer to (VII-5-(2)) [3] Checking if the inverter is broken or not
			10) Compressor failure	Check if the compressor is abnormally overheated while running. → Checking of refrigerant circuit (at the part of oil return). If no problem is found, replace the compressor.

Check codes			Meaning/Detection means	Trouble factors	Checking method and countermeasure
4250 (4210)	IPM failure (Failure details No. 101)		When detecting IPM error signal	1) Failures related to inverter output	(VII-5-(2)) Trouble shooting for trouble factors related to inverter output Refer to [1] ~ [5]
				2) Same as a failure No. 4230	Same as a failure No.4230
	Failure in ACCT over-current cut off (Failure details No. 102) Failure in DCCT over-current cut off (Failure details No. 103) Failure in overcurrent cut off (Failure details No. 106, 107)		When detecting over current cut off (150Apeak or 60Amps) by the current sensor	1) Failures related to inverter output	(VII-5-(2)) Trouble shooting for trouble factors related to inverter output Refer to [1] ~ [5]
	Failure in IPM short circuit/ground fault (Failure details No. 104)		When detecting IPM short circuit damage or ground fault at the load side just before the inverter starts	1) Compressor ground fault	Refer to (VII-5-(2)) [2] “Confirmation of compressor ground fault and winding wire failure”
				2) Matters related to inverter output	Refer to (VII-5-(2)) [5] Confirmation of inverter circuit trouble.
	Abnormal load short circuit (Failure details No. 105)		When detecting ground fault at the load side just before the inverter starts	1) Compressor ground fault	Refer to (VII-5-(2)) [2] “Confirmation of compressor ground fault and winding wire failure”
				2) Output wiring	Checking of short circuit.
				3) Power source	Check if power source voltage is 180V or more.
4260	Cooling fan failure		When heat sink temperature (THHS) is 95˚C or more for 10 minutes or more after the inverter starts	1) Same as a failure No. 4230	Same as a failure No.4230
5101	Sensor failure (Indoor unit)	Suction	If detecting sensor Short or Open while the thermostat is working, restart prevention mode for 3 minutes is alive. Unless sensor function is restored after 3 minutes from suspension, the indoor unit stops irregularly. If restored, the outdoor unit operates normally. Short: Detection of 90˚C or more Open: Detection of below –40˚C ❊ Sensor failure in the pipe on the gas side is not detected under the following condition: • In heating • In cooling: For 3 minutes after the compressor starts	1) Thermistor failure 2) Connecter contact failure 3) Thermistor wiring disconnection or semi-disconnection 4) No installation of thermo sensor or contact failure	Checking of the resistance value of thermistor. 0˚C : 15kΩ 30˚C : 4.3kΩ 10˚C : 9.7kΩ 40˚C : 3.1kΩ 20˚C : 6.4kΩ
5102		Liquid pipe			
5103		Gas pipe		5) Indoor board (Detection circuit) failure	Checking of connecter contact If no problem is found, it is an indoor board failure.
5104	(Lossnay)	Outdoor air temp.		1) Connecter CN29 is not firmly connected. 2) Outdoor air temperature sensor is out of work.	Checking of connecter contact Replacement of the sensor

Check codes			Meaning/Detection means	Trouble factors	Checking method and countermeasure
5101	Temperature sensor failure (Indoor unit)	Discharge (TH1)	(1) When detecting Short (High temperature import) or Open (Low temperature import) while operating, the unit stops irregularly. (2) When detecting Short or Open just before restart, the unit stops irregularly. At this moment, an error "5101" or "5106" is displayed on the screen. (3) During 3-minute restart prevention mode, an indication is displayed on the PC monitor. (4) The above Short or Open is not detected for 10 minutes after the compressor starts.	1) Thermistor failure	Checking of thermister resistance
				2) Engaged lead wire	Checking of engaged lead wire
				3) Damaged cover wire	Checking of damaged wire cover
5106		Outdoor air temp. (TH6)		4) Slipping off of pin at the connecting part and contact failure	Checking of slipping off of pins at connecting parts
				5) Disconnection	Checking of disconnection
				6) Failure of thermistor output circuit on the main board	Check the inlet temperature of the sensor by the LED monitor If the difference in temperature between detected and actual is large, replace the control board.
				Detection of Short / Detection of Open TH1 240˚C or above (0.57kΩ) / 15˚C or below (321kΩ) TH6 110˚C or above (0.4kΩ) / –40˚C or below (130kΩ)	
5110	THHS sensor /circuit failure		When detecting THHS Open and Short just before the inverter starts or while it is operating.	1) THHS sensor failure	Checking of the short circuit of THHS sensor
				2) Contact failure	Replacement of the THHS sensor
				3) INV board failure	Replacement of the INV board
5111	Temperature sensor failure (Outdoor unit)	Fan controller radiator panel (THBOX)	When THBOX sensor detects 90˚C or more, or Open.	1) Triac overheat	Checking of heat exchanger fan lock
				2) Thermistor failure	Checking of thermister resistance
				3) Engaged lead wire	Checking of engaged lead wire
				4) Damaged covered wire	Checking of damaged wire cover
				5) Slipping off of pin and contact failure at connecting parts	Checking of slipping off of pins at connecting parts
				6) Disconnection	Checking of disconnection
				7) Thermistor input circuit failure on the main board	Check the inlet temperature of the sensor by the LED monitor. If the difference in temperature between detected and actual is large, replace the main board.
				Detection of Open –20˚C or below (616kΩ)	
5201	High pressure sensor failure (Outdoor unit)	–	(1) If the high pressure sensor detects 0.098MPa or less while the outdoor unit is operating, it stops operation to be in 3-minute restart prevention mode. If the high pressure sensor detects 0.098MPa or more just before restart, the outdoor unit restarts. (2) If the high pressure sensor detects 0.098MPa or less just before restart, the outdoor unit stops operation irregularly. At this moment, an error "5111" is displayed on the screen. (3) During 3-minute restart prevention mode, LED in the intermittent fault check is carried out. (4) For 3 minutes after the compressor starts during defrosting and for 3 minutes after the restoration of defrosting failure detection is not available.	1) High pressure sensor failure	Refer to the page of the failure determination of the high pressure sensor. (VII-4-1)
				2) Inner pressure drop due to gas leak	
				3) Damaged wire cover	
				4) Slipping off of pins and contact failure at connecting parts	
				5) Disconnection	
				6) Failure in the input circuit on the main board of the high pressure sensor	

Check codes		Meaning/Detection means	Trouble factors	Checking method and countermeasure
5301	ACCT sensor circuit failure (Failure details No.115)	When detecting abnormal values in the ACCT circuit just before INV starts	1) INV board failure	Refer to (VII-5-(2)). [1] "Checking of the failure-detection circuit on the INV board"
			2) Compressor ground fault and IPM error	Refer to (VII-5-(2)). [2] "Checking of compressor ground fault and winding wire failure" Refer to (VII-5-(2)). [5] "Checking of the inverter circuit trouble"
	DCCT sensor circuit failure (Failure details No.116)	When detecting abnormal values in the DCCT circuit just before INV starts	1) Contact failure	Checking of contacts around the INV board connecter CNCT and DCCT side connecter
			2) INV board failure	Refer to (VII-5-(2)). [1] "Checking of the failure-detection circuit on the INV board"
			3) DCCT failure	In the case of no problem with up to 2), replace the DCCT and check DCCT polarity
			4) Compressor failure Inverter circuit failure	Refer to (VII-5-(2)). [2] "Checking of compressor ground fault and winding wire failure" Refer to (VII-5-(2)). [5] "Checking of the inverter circuit trouble"
			5) Compressor ground fault and IPM error	Refer to (VII-5-(2)). [2] "Checking of compressor ground fault and winding wire failure" Refer to (VII-5-(2)). [5] "Checking of the inverter circuit trouble"
	ACCT sensor circuit failure (Failure details No.117)	When detecting 3Amps < Effective value of output current < 3Amps while the inverter is working	1) Contact failure	Checking of contacts of the INV board CNCT2 (ACCT)
			2) ACCT sensor failure	Replacement of the ACCT sensor
	DCCT sensor circuit failure (Failure details No.118)	When detecting 3Amps < 3Apeak while the inverter is working	1) Contact failure	Checking of contacts at the connecting parts of INV board CNCT (DCCT) and DCCT side connectors
			2) DCCT sensor failure	Replacement of the DCCT sensor
			3) INV board failure	Replacement INV board
	IPM Open/CNCT2 slipping off failure (Failure details No.119)	When detecting IPM open break or CNCT2 slipping off just before the INV starts (In the case that current is undetectable satisfactorily by self-diagnosis just before the INV starts).	1) ACCT sensor slipping off	Confirm CNCT2 sensor connection (Confirm ACCT mounting status.)
			2) Wiring connection failure	Confirmation of the connections of CNDR2 on the INV board and CNDR1 on the G/A board
			3) ACCT sensor failure	Refer to (VII-5-(4)). "Current sensor ACCT" Confirmation of resistance
			4) Compressor wiring disconnection	Refer to (VII-5-(2)). [2] "Checking of compressor earth fault and winding wire failure"
			5) Inverter circuit error	Refer to (VII-5-(2)). [5] "Checking of the inverter circuit trouble"
	Faulty wiring detection failure (Failure details No. 120)	Detection of improper fixing of the ACCT sensor	1) Wrong fixing of ATTC sensor	Refer to (VII-5-(4)). [5] "Current sensor ACCT"

(2) Abnormal communication

Check codes	Meaning/Detection means	Trouble factors	Checking method and countermeasure
6500	Communication error, setting error, and transmission error These errors are detected when setting from PC is not available and the unit operates in a different way than set up by the PC.	1) • Setting of the PC communication port • Faulty serial port of PC	• Confirm if the communication port is set to COM1. • Replace the PC.
		2) Variation of the operation mode of the outdoor unit (Only for the case that there is even one of indoor units with Ver.30 or under or Losnay with a humidifier with Ver.8.08 or under)	Confirm if operation is controlled from the system controller for the indoor system, MA remote control, or other controller.
		3) Transmission line RS-232C is slipped off	Confirmation of the connection of transmission line RS-232C.
		4) Power failure and instantaneous stopping	Confirmation of item 4106.
		5) Change of a transmission signal due to noise 6) Reset of a unit due to noise	Examine the transmitted wave pattern and noise on the transmission line. The examination method is according to <Examination procedure for transmitted wave pattern and noise>.
		7) M-NET transmission error	Confirmation of the connection of M-NET transmission line. (Checking of disconnection and the connection to the terminal block).
		8) Main board–INV board serial communication error	Confirmation of the wiring between the main board and the INV board and the connecter.
		9) Board failure	If no problem is found with the above, replace the board due to board failure. (Main board, INV board, or MN converter)
6600	Multiple address error This error is detected when it is confirmed that the unit with the same address is transmitting massages. Note: The address and property indicated on the remote control indicate a controller that detects errors.	1) There are two or more units with the same address among controllers for outdoor units, indoor units, Losnay units, and remote controllers. 2) When a signal is changed due to noise entry in transmission signal	When 6600 error occurs, release the failure by the remote control (stop key control) to restart. a) In the case that the error occurs once again within 5 minutes, search for the unit with same address as that of the unit from which the error has originated. When the same address is identified, after correcting the address, leave the power sources of outdoor unit, indoor unit, and Losnay unit to be off all together for 5 minutes or more. And then the power is again turned on. b) In the case that no failure occurs in operation for 5 minutes or more, examine the transmitted wave pattern and noise. The examination method is according to <Examination procedure for transmitted wave pattern and noise>.

(3) System failure

<table>
<tr><th colspan="2">Check codes</th><th>Meaning/Detection means</th><th>Trouble factors</th><th>Checking method and countermeasure</th></tr>
<tr><td>7100</td><td>Outdoor unit</td><td>Total capacity error
A failure indicated when the total capacity of indoor units in the same refrigerant system exceeds the regulated value.</td><td>1) The total capacity of the model name of unit in the same refrigerant system exceeds the total capacity in the following table.
<table><tr><th>Model</th><th>Total capacity</th></tr><tr><td>P200</td><td>260</td></tr><tr><td>P250</td><td>325</td></tr></table></td><td>a) Confirm the total model names of indoor units to be connected (Sum total of capacity code)
b) Confirm the switch (Indoor controller board SW2) for setting the model name of units (capacity codes) to be connected.
In the case of mismatching with a model name, correct the model name (capacity code) and switch for model-name setting in the state that power sources for both outdoor units and indoor units are cut off.</td></tr>
<tr><td></td><td></td><td></td><td>2) Setting of model selection switch for outdoor units is wrong. (SW3-10)</td><td>Confirm the model selection switch for outdoor units (Refer to the table below for out-door dip switch on the main board.)
<table><tr><th>SW3-10</th><th>Model</th></tr><tr><td>OFF</td><td>P200</td></tr><tr><td>ON</td><td>P250</td></tr></table></td></tr>
<tr><td>7101</td><td>Outdoor unit

Indoor unit</td><td>Capacity code error
A failure indicated when the model name of unit to be connected can not be connected</td><td>1) The model name (model name code) of indoor unit to be connected is out of the connectable range.
The allowable range of connection:
Model P20 ~ P250</td><td>a) Confirm the model name (Model name code) of indoor units to be connected.</td></tr>
<tr><td></td><td></td><td></td><td>2) Setting of a model name (capacity codes) of indoor unit, heat storage tank unit, and switch for setting (SW2) is wrong.

❇The capacity of an indoor unit can be confirmed by means of the self-diagnosis function of outdoor unit (SW1 operation).</td><td>b) Confirm the switch for setting the model name (Capacity code) of indoor units and heat storage tank units and switches (SW2 for indoor controller board and SW1-10 for heat storage tank unit), from which address originate.
In the case of mismatching with a model name, correct the capacity code in the state that power sources for both outdoor units and indoor units are cut off.</td></tr>
<tr><td>7102</td><td>Outdoor unit</td><td>An error of excessive number of unit to be connected
A failure indicated when the number of unit to be connected to outdoor units is too many</td><td>1) The number of units connected to the indoor and outdoor transmission terminal block (TB3) is out of the following limit number of unit.
<table><tr><th>Items</th><th>Limit number of unit</th></tr><tr><td>(1) Total number of indoor units</td><td>1~16 (20)</td></tr><tr><td>(2) Total number of indoor units, Lossnay with heater and humidifier for commercial use, and network remote controller.</td><td>1~35</td></tr><tr><td>(3) Total number of Losnay with heater and humidifier for commercial use and Lossnay (Only when automatic addressing).</td><td>0 or 1</td></tr><tr><td>(4) Heat storage tank unit</td><td>1</td></tr></table>2) In spite of automatic addressing (MA remote control), the address of outdoor units is set to 51~100. (For MA remote control, an indication “HO” is displayed.)
3) The wiring for transmission line between outdoor units and heat storage tank units comes off.
4) The transmission line for outdoor units comes off (TB3).
5) Short circuit of transmission line
In the case of the above 4) and 5), indications on the remote control are as follows:
For M-NET remote control
No indication because the remote control has no its own power source
For M-NET remote control
An indication “HO” is displayed.
6) A failure in control board for outdoor units or heat storage tank units
7) Heat storage tank units are not energized.
8) For ICE Yk system, setting switch SW4-10 is not in the ON position.</td><td>a) Check if the number of outdoor units connected to the indoor transmission terminal block (TB3) is not beyond the limit number of unit.
((1) ~ (3) in the left column)

b) Check the item 2), 3), 4), 5), 7), and 8) in the left column.

c) Check if the transmission line to be connected to the terminal block (TB7) for transmission line for central control is not connected to the terminal block (TB3) for indoor and outdoor transmission line by mistake.

If no problem is found with a) ~ c), it is a control board failure of outdoor units or heat storage tank units.

❇When the power source for heat storage tank units is turned on later than outdoor units, a failure indication may be temporarily displayed on the screen (for about 3 minutes). However, in about 3 minutes it returns to normal.</td></tr>
</table>

Check codes		Meaning/Detection means	Trouble factors	Checking method and countermeasure
7105	Outdoor unit	Address setting error Address setting of outdoor units is wrong. Address setting of heat storage tank units is wrong.	1) Address setting error of outdoor units An address of 000 for outdoor unit is not set or the address is not set within the range of 51 ~100. 2) Address setting error of heat storage tank units An address of 000 for heat storage tank unit is not set or the address is not set within the range of 51~100.	a) Make sure the addresses of outdoor units and heat storage tank units are set to 00 or 51 ~100. When the addresses are set out of the range, make settings again in the state that the power source is cut off.
7106	OA processing unit	Attribute-setting error Switch setting of outdoor air processing unit is wrong.	Despite that the outdoor air processing is in the attribute FU mode (Interlocking mode from indoor units), the unit is directly connected to the control devices for indoor units such as MA remote control, ME remote control, and MELANS.	When direct control from controllers such as MA remote control, ME remote control, and MELANS, put SW3-1 of the outdoor air processing units in the ON position. Operation method (outdoor air processing unit) / SW3-1 setting Operation in the interlocked mode with indoor units: OFF Direct control from MA remote control, ME remote control, or MELANS: ON
7110		Units can not be operated due to an incorrect connection of indoor units to outdoor units in the refrigerant system.	1) Power cut-off of the transmission line booster 2) Power reset of the transmission line booster and outdoor units	a) Check if the power source for the transmission line booster is connected to the switch for indoor units. (If the power source for the transmission line booster is turned on, it does not operate normally. →Reset the power source for indoor units.)
7111	Indoor unit OA processing unit	Remote control failure A failure of no data transmission on temperature in spite of designating a remote sensor	1) When an old type of remote control for M-NET (Wide remote control) is used and a remote control sensor is designated for an indoor unit (SW1-1 is ON.)	a) Change the remote control for a M-NET remote control.
7113	Outdoor unit	Function setting error The function setting of outdoor units is not properly completed.	The connecter on the board of an outdoor unit is not properly connected.	Confirm the connection of the connecter.
7130	Indoor unit	Abnormal combination Indoor units to be connected have their model names for different refrigerant	A connected indoor unit is for model name J (Indoor unit exclusively for refrigerant R-22). The model name of an indoor unit to be connected is wrong.	Confirm the model name of indoor unit to be connected.

(4) Others

	Meaning/Detection means	Trouble factors	Checking method and countermeasure
Information-acquisition error on connection	An error detected when there is no response to information on connection from the outdoor unit for 5 minutes	1) This is not the case of ICE Yk system, but an outdoor unit is repeating start-up processing because the setting switch SW4-10 is in the ON position. 2) An outdoor unit is repeating start-up processing because the unit is reset due to noise.	a) Check the dip switch for the outdoor main board. b) Examine the transmitted wave pattern and noise on the transmission line. The examination method is according to < Examination procedure for transmitted wave pattern and noise >

(5) Content and countermeasure for operation trouble of remote controller

For MA remote controller system

Trouble phenomenon or checking codes	Trouble factors	Checking method and countermeasure
A running indication is displayed on the remote controller, but some of indoor units do not operate.	• The power source for indoor unit is not turned on • No wiring between indoor units in the same group • Indoor units are connected to the same group of Mr. Slim models • Blowout of the fuse on the control board of indoor units • During mineral oil recovery operation	• Confirm where a trouble has occurred among the following locations. 1) In overall system 2) In overall refrigerant system 3) Only in the same group 4) Only in one indoor unit
A running indication on the remote control goes out immediately after the indoor unit starts to operate.	• The power source for indoor unit (Main unit) is not turned on • Non conformity of grouping with system controller • Blowout of the fuse on the control board of the indoor unit (Main unit)	**In case of overall system and overall refrigerant system** • Check the self-diagnosis LED of outdoor unit. • Check the items related to outdoor units in the left column
The interlocking with Losnay can not be properly registered.	• The power source for Losnay is not turned on • For Losnay suitable for different refrigerant, the outdoor unit suitable for different refrigerant is not turned on • One Losnay is already registered to one of indoor units. • The address of Losnay is different • The address of Losnay is not set yet • Losnay is not connected to the transmission line	**In case of only in the same group and only in one indoor unit** • Check the items related to indoor units in the left column
The powering indication (◉) is not displayed on the remote controller. (No electric supply to MA remote controller.)	As for indoor units, the remote control is not fed until the start-up of both indoor and outdoor units is properly completed • The power source for indoor unit is not turned on. • The power source for outdoor unit is not turned on. • The number of connected remote controller exceeds 2 of the allowable number of remote controller or the number of connected indoor unit exceeds 16 of the allowable number of unit • The address of indoor unit is “00” and that of outdoor unit is other than “00” • The indoor/outdoor transmission line is connected to TB7 • Short circuit/disconnection of the indoor and outdoor transmission line • Short circuit/disconnection of M-NET remote controller • Blowout of the fuse for the control board of indoor unit	
The “HO” indication does not go off or appears repeatedly and periodically. (The indication is normally displayed for 3 minutes at the longest after the outdoor unit is turned on.)	• The power source for outdoor unit is not turned on. • The power source for transmission line booster is not turned on • Switching of Main and Sub for MA remote control is selected to Sub • MA remote control is connected to the indoor/outdoor transmission line • During mineral oil recovery operation	
The powering indication (◉) is displayed on the remote controller, but the unit does not operate.	• The power source for indoor unit (Main unit) is not turned on • The indoor/outdoor transmission line is connected to TB7 • Short circuit/contact failure of the indoor/outdoor transmission line • Blowout of the fuse for the control board of indoor unit (Main unit)	

For M-NET remote controller system

Trouble phenomenon or checking codes	Trouble factors	Checking method and countermeasure
A running indication is displayed on the remote controller, but some of indoor units do not operate.	• The power source for indoor unit is not turned on. • Address error in indoor unit or remote controller in the same group • When grouping units with different refrigerant, initial registration is not made with remote controller • Blowout of the fuse on the control board of indoor units • During mineral oil recovery operation	• Confirm where a trouble has occurred among the following locations. 1) In overall system 2) In overall refrigerant system 3) Only in the same group 4) Only in one indoor unit
A running indication on the remote controller goes out immediately after the indoor unit starts to operate.	• The power source for indoor unit is not turned on • Blowout of the fuse for the control board of indoor unit	**In case of overall system and overall refrigerant system** • Check the self-diagnosis LED of outdoor unit. • Check the items related to outdoor units in the left column
The interface with Losnay can not be properly registered.	• The power source of Losnay is not turned on • For Lossnay suitable for different refrigerant, the outdoor suitable for different refrigerant is not turned on. • One Lossnay is already registered to one of indoor units • The address of Lossnay is different • The address of Lossnay is not set yet • Losnay is not connected to the transmission line	**In case of only in the same group and only in one indoor unit** • Check the items related to indoor units in the left column
The powering indication (◉) is not displayed on the remote controller. (No electric supply to MA remote controller.)	• The power source for outdoor unit is not turned on. • The number of connected indoor units or remote controllers in the same refrigerant system exceeds the respective allowable number • M-NET remote controller is connected to MA remote controller wire • Short circuit/disconnection of the indoor/outdoor transmission line • Short circuit/disconnection of M-NET remote controller wire	
The “HO” indication does not go off or appears repeatedly and periodically. (The indication is normally displayed for 3 minutes at the longest after the outdoor unit is turned on.)	• The power source for feed extension for transmission line booster is not turned on • The address of indoor unit still remains “00” • Address-setting error of indoor unit or remote controller • MA remote control is connected to the indoor/outdoor transmission line • During mineral oil recovery operation	
The powering indication (◉) is displayed on the remote controller, but the unit does not operate.	• The indoor/outdoor transmission line is connected to TB7 • Switching of Main and Sub of MA remote controller is selected to Sub • Short circuit or disconnection/contact failure of the indoor/outdoor transmission line	

(6) The following phenomena are not failures (abnormality)

Phenomenon	Indications on remote controller	Causes
When “centralized control” is indicated on the indoor unit, heating (cooling) operation is not available.	Centralized control	• The unit is under centralized control
Even when indicating cooling (heating) operation, indoor units do not operate.	Blinking “Cooling (Heating)” indication	When other indoor unit is on heating (cooling) operation, cooling (heating) operation is not available.
The auto vane operates freely.	Normal indication	In one hour after air flow begins to blow downward by auto vane control in cooling operation, air flow may automatically change its blowing direction horizontally. While defrosting in heating operation, in “Hot-adjust” operation, and while the thermostat is OFF, air flow automatically becomes horizontal.
The wind velocity setting is switched during heating operation.	Normal indication	While the thermostat is OFF, air flow speed is in the “Very low” position. While the thermostat is ON, “Very low” position is automatically switched to the set position depending on time or pipe temperature.
The fan stops during heating operation.	Defrosting	In defrosting operation the fan stops.
Even with the operation of unit stopped, the fan keeps running.	Light out	When the auxiliary electric heater is ON, the fan operates for one minute after it stops to cool down remaining heat.
Even with the operation SW switched to the ON position, air velocity does not reach the setting value.	In preparation for heating Normal indication	For 5 minutes after the switch is ON or until the pipe temperature reaches 35˚C air speed is in the “Very low” position, then for 2 minutes it is in the “Low” position. (Hot-adjust control)
In operation, outdoor units do not operate.	Normal indication	When the outdoor unit experiences very low temperatures i.e. danger of liquid refrigerant being present in the compressor a warming up operation is performed for 35 minutes at the longest in order to heating the compressor. (When outdoor air temperature is below 0˚C, the unit does not operate for 4 hours at the longest after power source is turned on.) During warming up operation the fan is operating. Outdoor units do not operate before operation in mineral oil recovery.
When the main power source is turned on, an indication shown in the right column is displayed on the remote control of indoor unit for about 2 minutes.	Blinking “HO” indication	The system is starting up. After blinking “HO” indication goes out, operate the remote controller.
Even with the unit operation stopped, the drain pump does not stop.	Light out	While the unit stops cooling operation, the drain pump operates for 3 minutes after the compressor stops.
In shutdown, the drain pump keeps working.		Even while the unit stops, in the case that drain water comes out, operate the drain pump.
An indication shown in the right column continues to be displayed on the remote control or system controller.	Blinking “HO” indication Error indication	The unit is on mineral oil recovery operation. After the “HO” blinking indication light or the error indication light goes off, operate the remote control or system controller.
Indoor units do not operate according to the direction of remote controller of indoor unit.	Normal indication Light out	During mineral oil recovery operation the indoor unit operates in accordance with other operation indication than shown on the remote controller. (Air velocity, drain pump, etc.)
At the time of changeover cooling and heating operation, noise may generate from the indoor unit.	Normal indication	The noise is the sound of the change-over of refrigerant circuit, it is not a failure.
Immediately after the unit starts operation, refrigerant-flowing noise may generate from the indoor unit.	Normal indication	The noise generates due to the instability of transitional refrigerant flow, it is not a failure.
At the time of operation other than heating operation, warm air may come out.	Normal indication	As it is due to a slight opening of LEV for the purpose of preventing refrigerant accumulating in the indoor unit at the time of operation other than heating operation, it is not a failure. If it becomes a trouble, deal with it according to [I-5. Instructions at equipment selection] in System Design and Engineering Works Manual

3. Investigation of transmission wave shape/noise

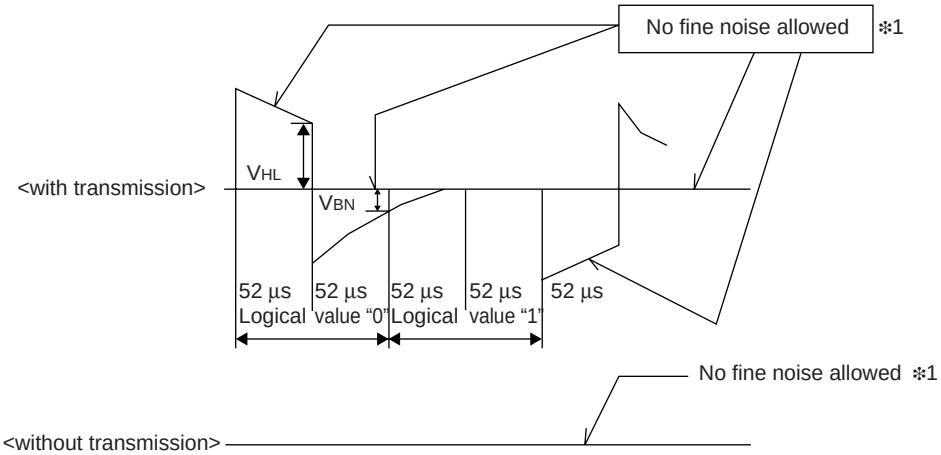
(1) M-NET transmision

Control is performed by exchanging signals between outdoor unit, indoor unit and remote controller by M-NET transmission. If noise should enter into the transmission line, the normal transmission will be hindered causing erroneous operation.

1) Symptom caused by the noise entered into transmission line

Cause	Erroneous operation	Error code
Noise entered into transmission line	Signal changes and is misjudged as the signal of other address.	6600
	Transmission wave shape changes to other signal due to noise.	6602
	Transmission wave shape changes due to noise, and can not be received normally thus providing no reply (ACK).	6607
	Transmission can not be made continuously due to the entry of fine noise.	6603
	Transmission can be made normally, but reply (ACK) or answer can not be issued normally due to noise.	6607 6608

2) Method to confirm wave shape



Check the wave shape of transmission line with an oscilloscope to confirm that the following conditions are being satisfied.

① The figure should be 104µs/bit ± 1%.
② No finer wave shape (noise) than the transmission signal (52µs ± 1%) should be allowed. ❊1
③ The sectional voltage level of transmission signal should be as follows.

Logic value	Transmission line voltage level
0	V_{HL} = 2.0V or more
1	V_{BN} = 1.3V or less

❊1 However, minute noise from the DC-DC converter or inverter operation may be picked up.

3) Checking and measures to be taken

(a) Measures against noise

Check the items below when noise can be confirmed on wave shape or the error code in the item 1) is generated.

	Items to be checked	Measures to be taken
Checking for wiring method	① Wiring of transmission and power lines in crossing.	Isolate transmission line from power line (5cm or more). Never put them in a same conduit.
	② Wiring of transmission line with that of other system in bundle.	Wire transmission line isolating from other transmission line. Wiring in bundle may cause erroneous operation like crosstalk.
	③ Use of shield wire for transmission line (for both indoor unit control and centralized control).	Use specified transmission wire. Type : Shield line CVVS/CPEVS Wire diameter : 1.25mm^2 or more
	④ Repeating of shield at the repeating of transmission line with indoor unit.	The transmission line is wired with 2-jumper system. Wire the shield with jumper system as same for transmission line. When the jumper wiring is not applied to the shield, the effect against noise will be reduced.
	⑤ Are the unit and transmission lines grounded as instructed in the INSTALLATION MANUAL?	Connect to ground as shown in the INSTALLATION MANUAL.
Check for earthing	⑥ Earthing of the shield of transmission line (for indoor unit control) to outdoor unit.	One point earthing should be made at outdoor unit. Without earthing, transmission signal may be changed as the noise on the transmission line has no way to escape.
	⑦ Arrangement for the shield of transmission line (for centralized control).	For the shield earth of the transmission line for centralized control, the effect of noise can be minimized if it is from one of the outdoor units in case of the group operation with different refrigerant systems, and from the upper rank controller in case the upper rank controller is used. However, the environment against noise such as the distance of transmission line, the number of connecting sets, the type of connecting controller, and the place of installation, is different for the wiring for centralized control. Therefore, the state of the work should be checked as follows. a) No earthing • Group operation with different refrigerant systems One point earthing at outdoor unit • Upper rank controller is used Earthing at the upper rank controller b) Error is generated even though one point earth is being connected. Earth shield at all outdoor units. Connect to ground as shown in the user's manual.

(b) When the wave height value of transmission wave shape is low, 6607 error is generated, or remote controller is under the state of "HO."

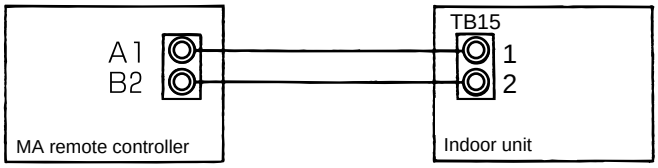
	Items to be checked	Measures to be taken
	⑧ The farthest distance of transmission line is exceeding 200m.	Confirm that the farthest distance from outdoor unit to indoor unit/ remote controller is less than 200m.
	⑨ The types of transmission lines are different.	Use the transmission wire specified. Type of transmission line : Shield wire CVVS/CPEVS Wire dia. of transmission line : 1.25mm^2 or more
	⑩ No transmission power (30V) is being supplied to the idoor unit or the remote control.	a) Check 30V on CNS1, CNS2. b) Remove CNS1 and CNS2 and check resistance is 5-2, 6-2, if not this is a fault. Check main board R3 resistance is 1k±5%, if not this is a fault.
	⑪ Faulty indoor unit/remote controller.	Replace outdoor unit circuit board or remote controller.

(2) MA remote control transmission

The MA remote control and indoor unit communicate with the current tone burst method.

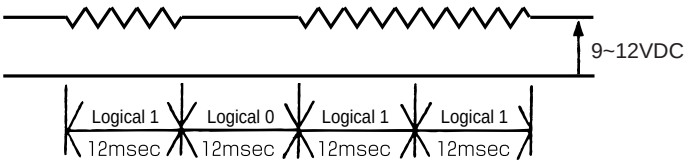
1) Symptoms caused by infiltration of noise on transmission cable
   If noise, etc., infiltrates the transmission cable and the communication between the MA remote control and indoor unit is cut off for three consecutive minutes, a MA communication error (6831) will occur.

2) Confirmation of transmission specifications and waveform



A1, B2: No polarity
Across terminal No. 1-2 :
Power supply (9V to 12VDC)

Transmission waveform (Across terminal No. 1-2)



(1) 2msec/bi t±5% must be satisfied
(2) Voltage across terminal No.1-2 must be within range shown on left.

Transmission power circuit (30V) check procedure

If "◎" is not displayed by the remote control, investigate the points of the trouble by the following procedure and correct it.

No.	Check Item	Judgment	Response
1	Disconnect the transmission line from TB3 and check the TB3 voltage.	DC24 ~ 30V	Check the transmission line for the following, and correct any defects. Broken wire, short circuit, grounding, faulty contact.
		Except the above-mentioned	to No. 2
2	Check if the following connectors are disconnected in the outdoor unit's control box. MAIN Board: CNS1, CNVCC3, CNVCC4 INV Board: CNVCC2, CNVCC4, CNL2, CNR, CNAC2	Connector disconnected	Connect the connectors as shown on the electric wiring diagram plate.
		Except the above-mentioned	to No. 3
3	Disconnect the wires from CNVCC3 on the Main board and check the voltage between pins 1 and 3 on the wire side of the CNVCC3. Tester ⊕ ..... 1 pin Tester ⊖ ..... 3 pin	DC24 ~ 30V	Check the wiring between CNS1 and TB3 for the following, and correct any defects. Broken wire, short circuit, grounding, faulty contact. If there is no trouble, replace the main board.
		Except the above-mentioned	to No. 4
4	Disconnect the wiring from CNVCC2 on the INV board and check the voltage between pins 1 and 3 of CNVCC2. Tester ⊕ ..... 1 pin Tester ⊖ ..... 3 pin	DC24 ~ 30V	Check the wiring between CNVCC2 and CNVCC3 for the following, and correct any defects. Broken wire, short circuit, grounding, faulty contact.
		Except the above-mentioned	to No. 5
5	Disconnect the wiring from CNL2 on the INV board, and check the resistance at both ends of choke coil L2.	0.5 ~ 2.5Ω	to No. 6
		Except the above-mentioned	Replace choke coil L2.
6	Disconnect the wiring from CNR on the INV board, and check the resistance at both ends of R7.	19~25Ω	to No. 7
		Except the above-mentioned	Replace R7.
7	Check the resistance at both ends of F01 on the INV board.	0Ω	to No. 8
		Except the above-mentioned	Replace F01
8	Check the voltage between pins 1 and 3 of CNAC2 on the INV board.	AC198 ~ 264V	Replace the INV board.
		Except the above-mentioned	to No. 9
9	Check the voltage between L2 and N on power supply terminal block TB1.	AC198 ~ 264V	Check the wiring to CNAC2 for the following and correct any defects. Broken wire, faulty contact.
		Except the above-mentioned	Check the power supply wiring and base power supply, and correct any defects.

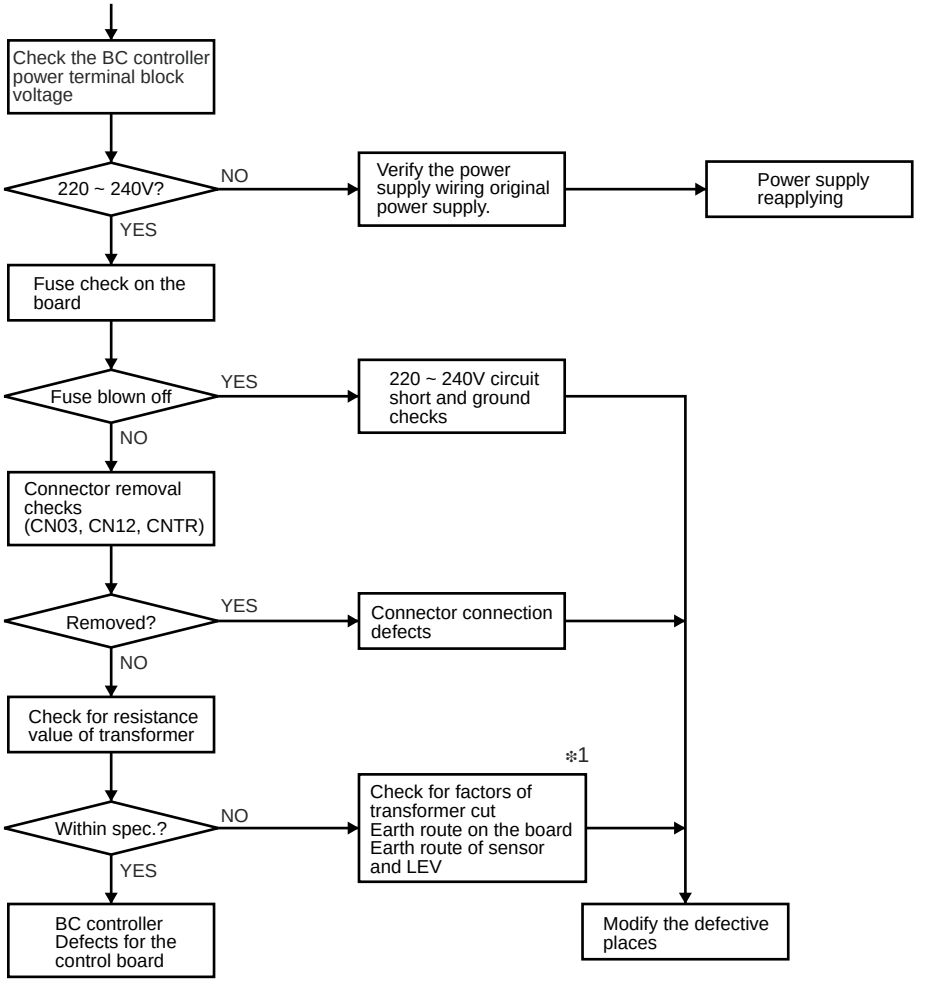
(3) Trouble and remedy of remote controller

(In the case of MA remote controller)

	Phenomena	Factors	Check method and handling
1	If pushing the remote control operation SW does not make a sound such as feep with the crystal display lamp out, and no operate is possible. (An appropriate display ◎ on the remote control is not on.)	1) Power supply from transformers is not turned on in indoor unit. ① The original power supply of indoor unit is not turned on. ② The connector (CND, CNT, CN3T) on the controller board in the room has come off. ③ Fuse on the control board in Indoor Unit has melting down. ④ Transformer defects or damage to unit. 2) MA remote controller has been wired incorrectly. ① Break of the MA remote controller line and the connection to the terminals has come off. ② Short circuit of the MA remote control wiring ③ Reversed connections of the wiring on remote controller. ④ Incorrect connection of the MA remote control wiring to the transmission line terminal block (TB5). ⑤ Reversed connections between the MA remote control wiring in the indoor unit and AC 200V power supply wiring. ⑥ Reversed connection between the MA remote control wiring in the indoor unit and M-NET transmission wiring. 3) The maximum number of MA remote controllers connected to one is unit exceeded (two units). 4) The wiring length of the MA remote line and the used electric wire diameter is out of specifications. 5) The wiring of the remote display output to the outdoor unit is short circuited, or the relay is connected with reversed polarity. 6) Defective of the controller board in the room 7) Defects of MA remote control	a) Check the MA remote control terminal voltage (between A and B). i) In the case of voltage DC8.5-12V, the remote controller is defective. ii) In the case of voltage not available: • Check the left described 1) and 3), after checking , if these are factors, then modifications should be performed. • If there are no factors of the left described 1) and 3), move to b). b) Remove the remote control wiring from the terminal block TB13 for the MA remote control in the indoor unit, and check voltage between A and B. i) In the case of voltage DC9-12V Check the left described 2) and 4), if these are factors, then modifications should be performed. ii) In the case of voltage not available: • Recheck the left described 1) once again, if this is a factor, them modifications should be performed. • If there are no factors in the left described 1), check the wiring for the remote display (the relay polarity, etc.) • If there are no factors, replace the controller board in the indoor unit. In the case of item 1), the LED 1 on the controller board in the unit is off.
2	When turning on the remote control operation SW, a temporary operation display is indicated, and the display lights out immediately, the unit stops.	1) M-NET transmission power supply from the outdoor unit is not supplied. ① The original power supply of the outdoor unit is not turned on. ② Disconnection of connectors on the board of the outdoor unit. Main board : CNS1, CNVCC3 INV board : CNAC2, CNVCC1, CNL2 ③ Power supply circuit defects of the outdoor unit. • INV board defects • Blown fuse (F1 on INV Board) • Diode stack destruction • Prevention resistance of rush current (R1) damage 2) Transmission line short 3) Wiring mistakes of the M-NET transmission line on the side of the outdoor unit ① Break of transmission line, and removal of terminal block ② The room transmission line is wired to the transmission line terminal block (TB7) for the central control by mistakes. 4) M-NET transmission line break on the side of the room unit 5) Disconnection off wiring between the M-NET transmission terminal block (TB 5) and the room controller board CN2M and pulls off of connectors	In the case of factors 2) and 3) Indicated by 7102 error code on the self-diagnosis LED of the outdoor unit.

	Phenomena	Factors
3	When the remote control SW is turned on, the indication goes off after approximately 20-30 seconds, and indoor unit stops.	1) Power supply from the transformer is not available to the control board of BC controller. ① The original power supply of the BC controller is not turned on. ② Removal of connectors (CN12, CN38, CNTR) on the control board of the BC controller. ③ Fuse on the control board of the BC controller is blown. ④ Transformer defects of the BC controller and a malfunction. ⑤ Defects on the control board of the BC controller

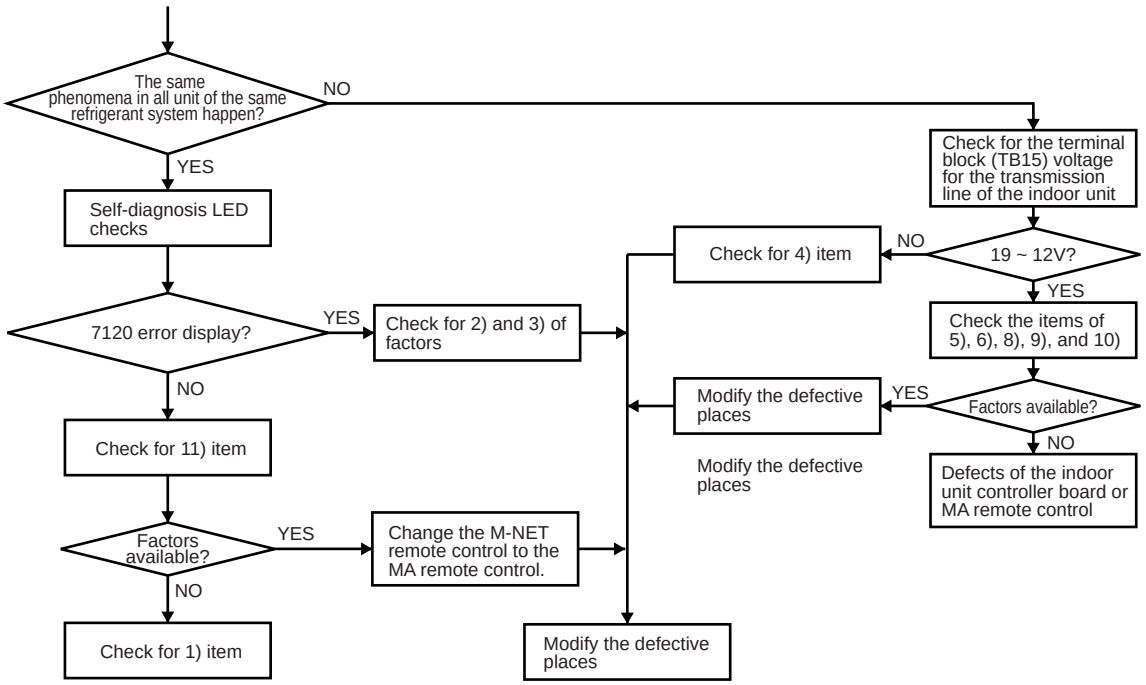
Check method and handling



※1 As for transformer checks, It is subject to the failure judgment method of main parts in 4.5.

	Phenomena	Factors	
4	"HO" indication on the remote controller is not lit, and the ON/OFF switch does not work.	1) The M-NET transmission power supply form the outdoor unit is not supplied. ① The original power supply of indoorunit is not turned on. ② The connector on the controller board in indoor unit is removed. Main board : CNS1, CNVCC3 INV board : CNAC2, CNVCC1, CNL2 ③ Power supply circuit defects of the outdoor unit. • INV board defects • Diode stack defects • Prevention resistance of rush current (R1) damage. 2) Short circuit of the M-NET transmission line 3) Error wiring of the M-NET transmission line on the side of the outdoor unit ① A break of the transmission line or terminal block removal ② Indoor Unit transmission line is wired to the transmission line terminal block (TB7) for the central control by mistake. 4) M-NET transmission line break on the side of Indoor Unit (Short/ Open) 5) Loose or disconnection of wiring between the M-NET transmission terminal block (TB 5) of Indoor Unit and Indoor Unit controller board CN2M and disconnection of connectors 6) Error wiring of the MA remote control ① Short circuit of the MA remote wiring ② A break of the MA remote control line (No.2) and disconnection of the terminal block connection ③ Reversed wiring, cross-over in the group control ④ Wire by mistakes the MA remote control to the terminal block (TB5) for the transmission line ⑤ Connect by mistakes the M-NET transmission line to the MA remote control terminal block (TB13) 7) The unit address is not "00" as it should be with automatic address setting. 8) The address of Indoor Unit becomes 51 or more. 9) The master and slave setting of the MA remote control becomes the slave setting. 10) Use the M-NET remote control in spite of the automatic address. 11) Defects for the room controller board (MA remote communication circuits) 12) Defects for the remote controller	In the case of 2), 3) and 7) factors, indicate 7102 errors by the self-diagnosis LED of the outdoor unit.

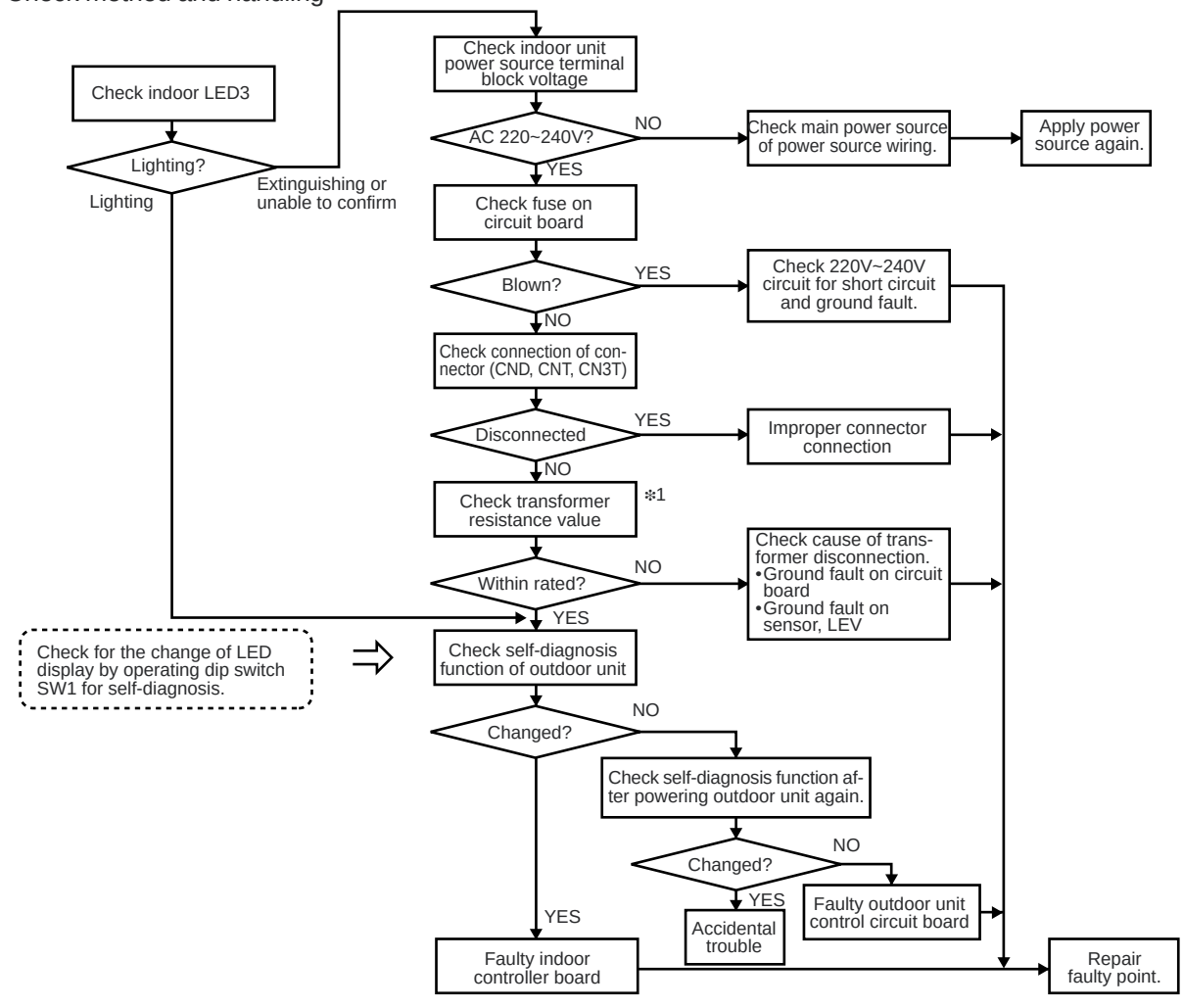
Check method and handling


The same phenomena in all unit of the same refrigerant system happen?
NO
YES
Self-diagnosis LED checks
7120 error display?
YES
Check for 2) and 3) of factors
NO
Check for 11) item
Factors available?
YES
Change the M-NET remote control to the MA remote control.
NO
Check for 1) item
Modify the defective places
Check for 4) item
Modify the defective places
Check for the terminal block (TB15) voltage for the transmission line of the indoor unit
19 ~ 12V?
NO
YES
Check the items of 5), 6), 8), 9), and 10)
Factors available?
YES
NO
Defects of the indoor unit controller board or MA remote control

(In the case of M-NET remote controller)

	Symptom	Cause	Check method & Countermeasure
1	Despite pressing of remote controller ON/OFF switch, operation does not start and there is no electronic sound. (No powering signal ◎ appears.)	1) M-NET transmission power source is not supplied from outdoor unit. ① Main power source of outdoor unit is not connected. ② Disconnection of connector on outdoor unit circuit board. Main board : CNS1, CNVCC3 INV board : CNAC2, CNVCC1, CNL2 ③ Faulty power source circuit of outdoor unit. • Faulty INV board, • Blown fuse (F1 on INV board) • Broken diode stack • Broken resistor (R1) for rush current protection 2) Short circuit of transmission line. 3) Erroneous wiring of M-NET transmission line at outdoor unit. ① Transmission line disconnection or slipping off from terminal block. ② Erroneous connection of indoor/outdoor transmission line to TB7. 4) Disconnection of transmission wiring at remote controller. 5) Faulty remote controller.	a) Check transmission terminal block of remote controller for voltage. i) In case of 17 ~ 30V → Faulty network remote controller ii) In case of less than 17V → See “Transmission Power Circuit (30V) Check Procedure”. The cause of 2) and 3) is displayed with self-diagnosis LED for 7102 error.
2	At about 10 seconds after turning remote controller operation switch ON, the display distinguishes and the operation stops.	1) Power source is not fed to indoor unit from transformer. ① Main power source of indoor unit is not turned on. ② Disconnection of connector (CND, CNT, CN3T) on indoor controller board. ③ Blown fuse on indoor controller board. ④ Faulty or disconnected transformer of indoor unit. ⑤ Faulty indoor controller board.	
		2) Faulty outdoor control circuit board uncontrolled. As normal transmission is fails between indoor and outdoor units, outdoor unit model can not be recognized.	

Check method and handling

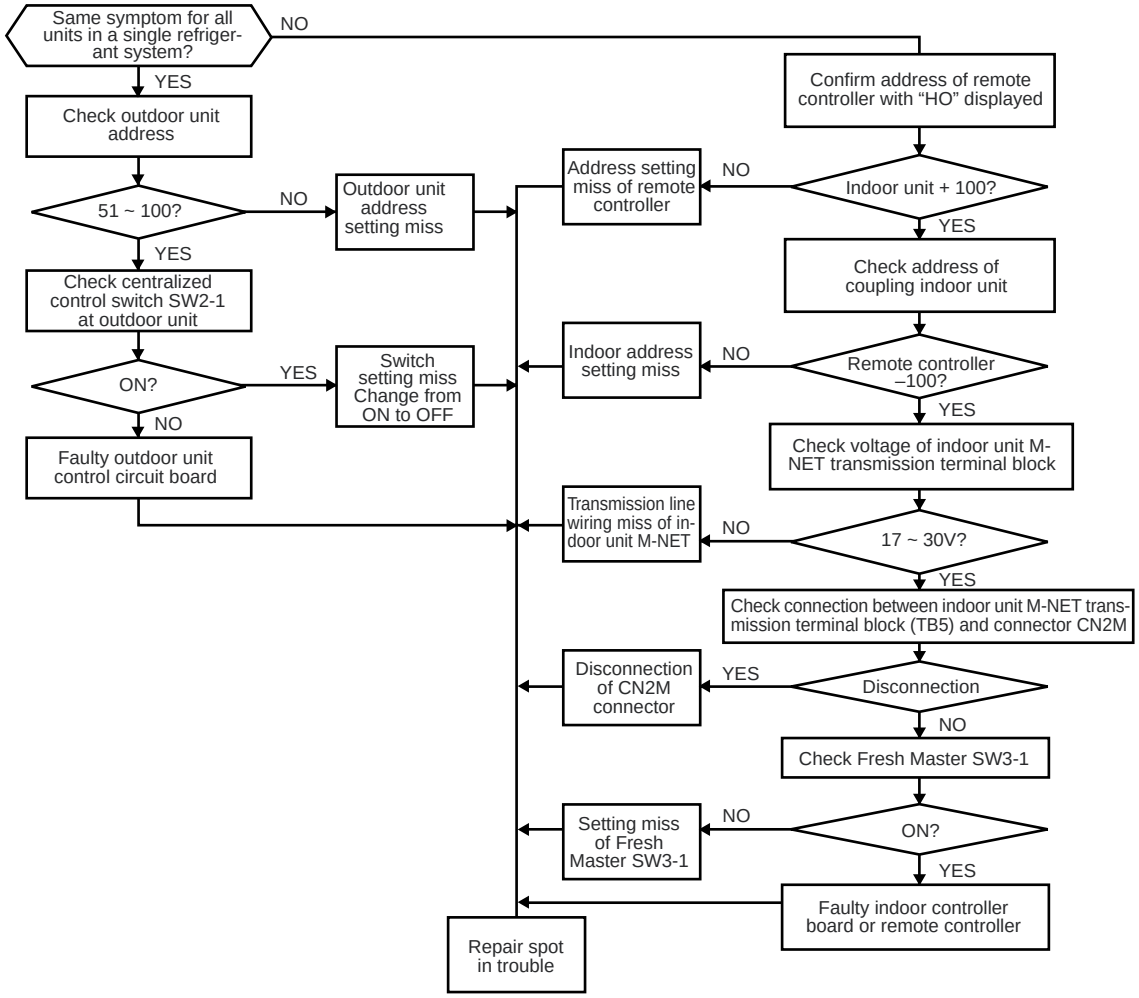


※1 Check the transformer in accordance with the “TROUBLESHOOTING” in the indoor unit’s service handbook.

	Symptom	Cause
3	"HO" display on re-mote controller does not dis-appear and ON/OFF switch is ineffective.	(Without using MELANS) 1) Outdoor unit address is set to "00" 2) Erroneous address. ① Address setting of indoor unit to be coupled with remote controller incorrect. (Indoor unit = remote controller – 100.) ② Address setting of remote controller incorrect. (Remote controller = indoor unit + 100.) 3) Faulty wiring of transmission terminal block TB5 of indoor unit in the same group with remote controller. 4) Centralized control SW2-1 of outdoor unit is turned ON. 5) Setting to interlocking system from indoor unit (Switch 3-1 = OFF), while Fresh Master is intended to be use by remote controller operation (indoor unit attribute). 6) Disconnection or faulty wiring of indoor unit transmission line. 7) Disconnection between indoor unit M-NET transmission line terminal block (TB5) and connector CN2M. 8) More than 2 sets of power supply connector (CN40) are inserted into centralized control transmission line of outdoor unit. 9) Faulty outdoor unit control circuit board. 10) Faulty indoor controller board. 11) Faulty remote controller. (Interlocking control with MELANS) 12) No grouping registration from MELANS (Neglecting to set the relation between indoor unit and network remote controller). 13) Disconnection of centralized control transmission line (TB7) at outdoor unit. 14) At system connected with MELANS, power supply connector (CN40) is inserted to centralized control transmission line of outdoor unit.

Checking method & countermeasure

In case MELANS is not used



In case with MELANS used

When MELANS is used, "HO" display on the remote controller will disappear at the group registration of the indoor unit and local remote controller.
If "HO" does not disappear after the registration, check the items 12) ~ 14) in the Cause column.

	Symptom	Cause	Check method & Countermeasure
4	“88” appears on re-mote controller at registration and access remote controller	[Generates at registration and confirmation] 1) Erroneous address of unit to be coupled. 2) Disconnection of transmission line of unit to be coupled (No connection). 3) Faulty circuit board of unit to be coupled. 4) Installation miss of transmission line.	a) Confirm the address of unit to be coupled. b) Check the connection of transmission line. c) Check the transmission terminal block voltage of unit to be coupled. i) Normal if voltage is DC17 ~ 30V ii) Check the item d) in case other than i).
		[Confirmation of different refrigerant system controller] 5) Disconnection of power source of outdoor unit to be confirmed. 6) Disconnection of centralized control transmission line (TB7) of outdoor unit. 7) Power supply connector (CN40) is not inserted into centralized control transmission line in grouping with different refrigerant system without using MELANS. 8) More than 2 sets of power supply connector are inserted into the centralized control transmission line of outdoor unit. 9) In the system connected with MELANS, power supply connector (CN40) is inserted into the centralized control transmission line of outdoor unit. 10) Short circuit of centralized control transmission line.	d) Confirm the power source of outdoor unit to be coupled with the unit to be confirmed. e) Confirm that the centralized control transmission line (TB7) of outdoor unit is not disconnection. f) Confirm the voltage of centralized control transmission line. i) Normal in case of 10V ~ 30V ii) Check the items 7) ~ 10) left in case other than i).

4. Troubleshooting for major parts of outdoor unit and indoor unit

4-1 Pressure sensor

(1) High pressure sensor (63HS)

(1) Check high pressure in comparison to detected pressure and high pressure gauge pressure.

a. Compare gauge pressure to monitored pressure in operation conditions.
- When the gauge pressure is around 0 ~ 0.098MPa →Decrease in inner pressure due to gas leak
- When the monitored pressure is around 0 ~ 0.098MPa → Contact failure of the connecter, Go to d. after confirmation of the contact failure
- The monitored pressure is 2.96MPa or more → Go to c.
- In other case than those above, compare pressure on an actual operation → Go to b.

b. Compare gauge pressure to monitored pressure in operation condition.
- When the pressure difference between the two is within 0.098MPa → Both high pressure sensor and main board are normal.
- When the pressure difference between the two is beyond 0.098MPa → A high pressure sensor failure (Characteristics deterioration)
- When no pressure difference between the two is found → A high pressure sensor failure

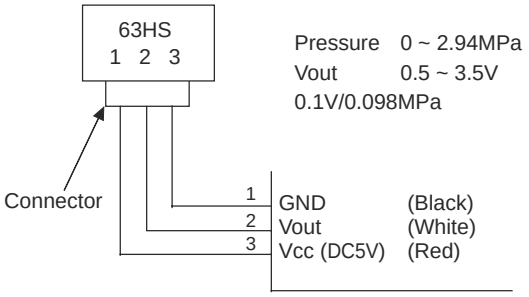
c. Remove the high pressure sensor from the main board and check monitored pressure.
- The monitored pressure is around 0 ~ 0.098MPa → A high pressure sensor failure
- The monitored pressure is around 2.96MPa → A main board failure

d. Remove the high pressure sensor from the main board and check monitored pressure with the connecter (63HS) short-circuited between No. 2 ~ No. 3.
- When the monitored pressure is beyond 2.96MPa → A high pressure sensor failure
- In other case than the above → A main board failure

(2) Composition of high pressure sensor

The high pressure sensor is composed of the circuit illustrated on the right hand figure. Application of DC5V between lead wires red and black generates power pressure according to pressure between lead wires white and black, of which power pressure is taken into the micro computer.

The output voltage is 0.1V per 0.098MPa.



❇ The pressure sensor main body side is of specifications for connecting the connecter.
The pin number of connecter for the pressure sensor main body side and the main board side is different respectively.

	Main body side	Main board side
Vcc	1-pin	3-pin
Vout	2-pin	2-pin
GND	3-pin	1-pin

(2) Low pressure sensor (63LS)

(1) Check low pressure in comparison to detected pressure with the sensor.

a. Compare gauge pressure with monitored pressure in operation conditions.
- When the gauge pressure is around 0 ~ 0.098MPa → Decrease in inner pressure due to gas leak
- When the monitored pressure is around 0 ~ 0.098MPa → Contact failure of the connecter, Go to d. after confirmation of the contact failure
- The monitored pressure is 2.96MPa or more → Go to c.
- In other cases than those above, compare pressure on an actual operation → Go to b.

b. Compare gauge pressure with monitored pressure in operation conditions.
- When the pressure difference between the two is within 0.03MPa → Both high pressure sensor and main board are normal.
- When the pressure difference between the two is beyond 0.03MPa → High pressure sensor failure (Characteristics deterioration)
- When no pressure difference between the two is found → High pressure sensor failure

c. Remove the low pressure sensor from the main board and check the monitored pressure
- The monitored pressure is around 0 ~ 0.098MPa → Low pressure sensor failure
- The monitored pressure is around 2.96MPa → Main board failure
  At the outdoor temperature of 30˚C or below → Main board failure
  At the outdoor temperature of above 30˚C → Go to e.

d. Remove the low pressure sensor from the main board and check the monitored pressure with the connecter (63LS) short-circuited between No. 2 ~ No. 3.
- When the monitored pressure is beyond 1.37MPa → Low pressure sensor failure
- In other case than the above → Main board failure

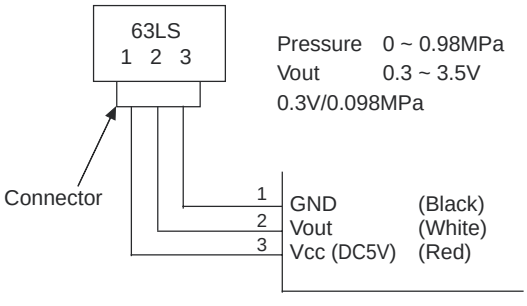
e. Remove the high pressure sensor (63HS) from the main board and check the monitored pressure with low pressure sensor (63LS) inserted.
- When the monitored pressure is beyond 1.37MPa → Main board failure
- In other case than the above → Low pressure sensor failure

(2) Composition of high pressure sensor

The low pressure sensor is composed of the circuit illustrated in the figure below. Impressing DC5V between red and black generates power pressure according to pressure between white and black, of which power pressure is taken into the microcomputer.
The output voltage is 0.3V per 0.098MPa.

❇ The pressure sensor main body side is of specifications for connecting the connecter.
The pin number of connecter for the pressure sensor main body side and the main board side is different respectively.

	Main body side	Main board side
Vcc	1-pin	3-pin
Vout	2-pin	2-pin
GND	3-pin	1-pin



4-2 Solenoid valves (SV1 and SV2)

Confirm if the output signal of the control board is in accordance with the action of the solenoid valve.

(1) For SV1 (Bypass valve)

(1) Since SV1 is ON for 15 minutes after starting the compressor, confirm the action with the sound of solenoid valve action.

(2) Switching of operation condition by solenoid valve action can be confirmed by the temperature of the bypass circuit or the sound of refrigerant flow.

(2) For SV2 (Bypass valve)

(1) Since SV2 is ON for 4 minutes after starting the compressor, confirm the action with the sound of solenoid valve action.

(2) Switching of operation condition by solenoid valve action can be confirmed by the temperature of the bypass circuit or the sound of refrigerant flow.

(3) For 21S4 (4-way valve)

The 4-way valve is;

At no powering (OFF) : Powering between the oil separator outlet and the heat exchanger and between the gas ball valve (BV1) and the accumulator in cooling cycle

At powering (ON) : Powering between the oil separator and the gas ball valve and between the heat exchanger and the accumulator in heating cycle

You can confirm if the 4-way valve is working normally by checking which part is powering with the LED indication and actual inlet and outlet temperature of the 4-way valve.

❇ Be sure not to cause any damage to the outer shell of the valve from outside as deformation of the outer shell may cause a malfunction and miss operation of the inner valve.

4-3 Outdoor unit fan

- As the fan revolution speed of outdoor unit is controlled by the phase control system, check the fan revolution speed by confirming the output state of the phase control output on the monitor tool. The revolution speed is about 600 rpm at full speed.
- For fan control, refer to the item of the control of outdoor unit.

4-4 LEV

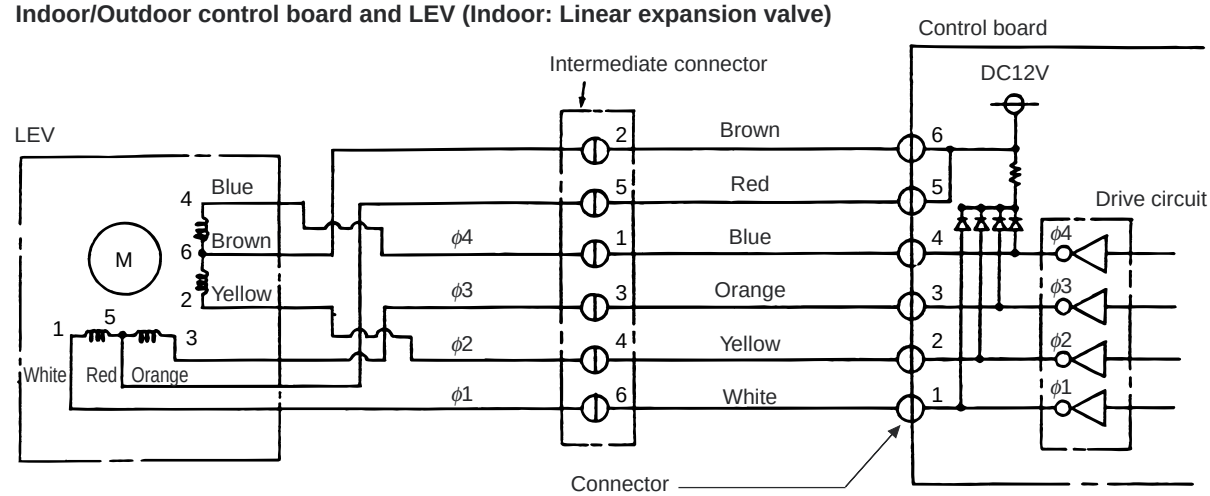
Outline action of LEV

LEV (Indoor: Linear expansion valve) and SLEV/LEV1 (Outdoor unit: Linear expansion valve) activate valves with the stepping motor by receiving a pulse signal from the indoor unit and outdoor unit main board.

(1) Indoor LEV

The valve opening varies in proportion to the number of pulses.

Indoor/Outdoor control board and LEV (Indoor: Linear expansion valve)



Note : As the number of intermediate connectors are different from that of the connector on the control board side, identify it with the color of lead wire.

Output (Phase) No.	Output state			
	1	2	3	4
ϕ1	ON	OFF	OFF	ON
ϕ2	ON	ON	OFF	OFF
ϕ3	OFF	ON	ON	OFF
ϕ4	OFF	OFF	ON	ON

Output of pulse signal and valve action

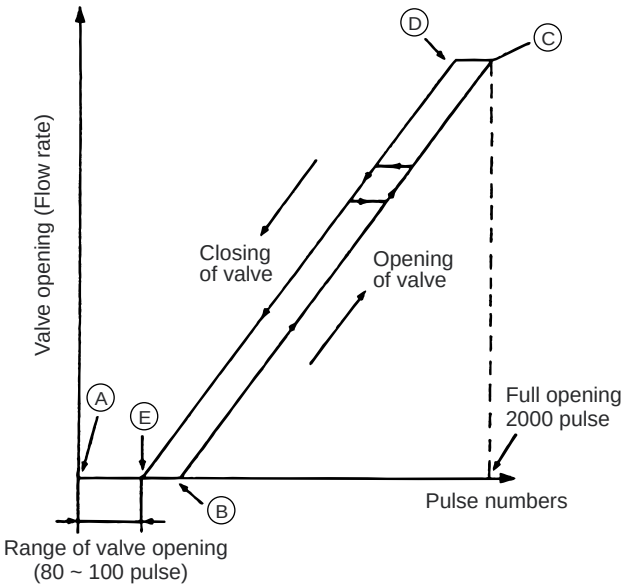
At valve opening: 1 → 2 → 3 → 4 → 1

At valve closing: 4→ 3 → 2 → 1 → 4

Note : 1. When the valve opening does not vary, total output phase is OFF.

2. When output gets into open phase or remains ON, the motor can not rotate smoothly, resulting in generating ticking noise and vibration.

Closing and opening action of LEV



❇ At power-on, valve-opening signal with a 2200 pulse is sent to be sure to determine the position of the valve in the position Ⓐ.

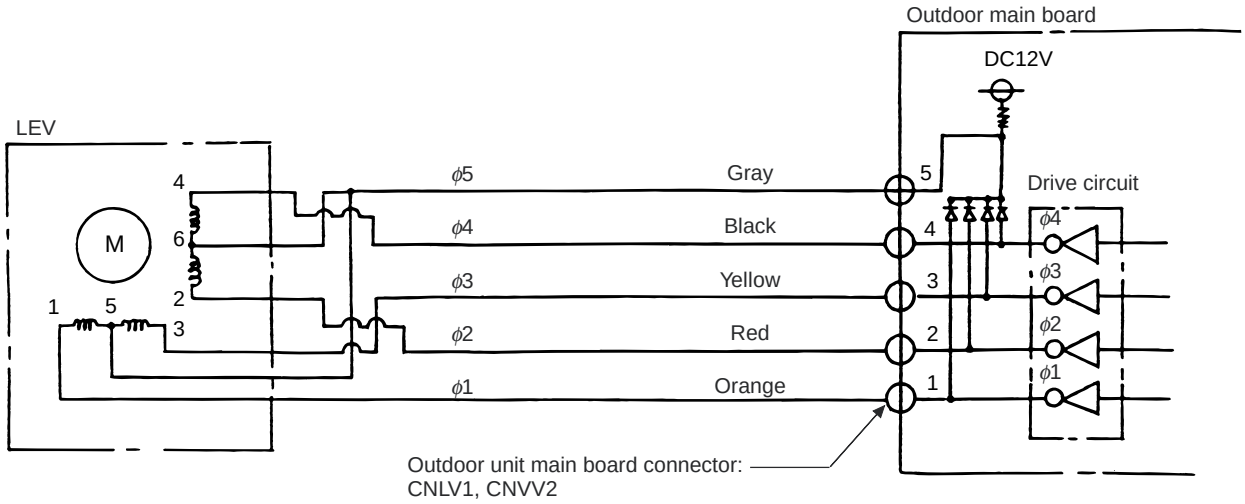
When the valve acts smoothly, no noise or vibration is generate from the LEV. However, when the valve acts from Ⓔ to Ⓐ or it is locked, a big noise is generated due to an open phase and other factors.

❇ Noise generation can be confirmed by applying a screwdriver to the valve and applying an ear to its handle.

(2) Outdoor LEV

The valve opening varies in proportion to the number of pulses.

Connection of outdoor main board and SLEV, LEV1 (outdoor electronic expansion valve)



Output (Phase) No.	Output state							
	1	2	3	4	5	6	7	8
ϕ1	ON	OFF	OFF	OFF	OFF	OFF	ON	ON
ϕ2	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
ϕ3	OFF	OFF	ON	ON	ON	OFF	OFF	OFF
ϕ4	OFF	OFF	OFF	OFF	ON	ON	ON	OFF

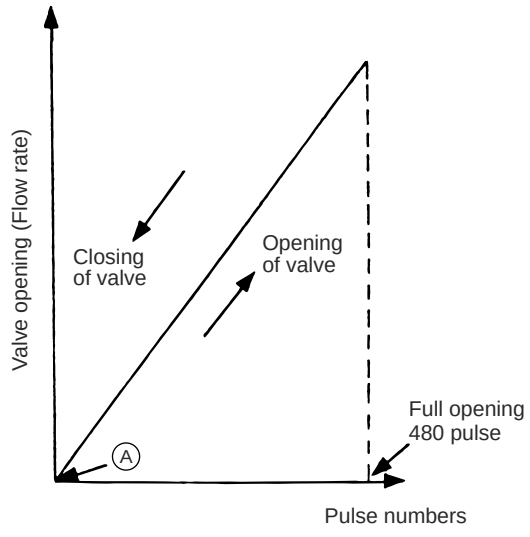
Output of pulse signal and valve action

At valve opening: $1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 5 \rightarrow 6 \rightarrow 7 \rightarrow 8 \rightarrow 1$

At valve closing: $8 \rightarrow 7 \rightarrow 6 \rightarrow 5 \rightarrow 4 \rightarrow 3 \rightarrow 2 \rightarrow 1 \rightarrow 8$

Note : 1. When the valve opening does not vary, all output phases are OFF.
2. When output is open phase or remains ON, the motor can not rotate smoothly, resulting in generating ticking noise and vibration.

Closing and opening action of LEV



❇ At power-on, valve-closing signal with a 520 pulse is sent to be sure to determine the position of the valve in the position Ⓐ .
(The pulse signal is output for about 17 seconds.)

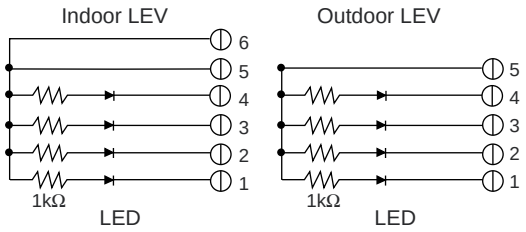
When the valve acts smoothly, no noise or vibration is generate from the LEV. However, when the valve is locked, a noise is generated .

❇ Noise generation can be confirmed by applying a screwdriver to the valve and applying an ear to its handle.

❇ When liquid refrigeration is present in the LEV, the noise may be low.

(3) Troubleshooting method and envisioned failure mode

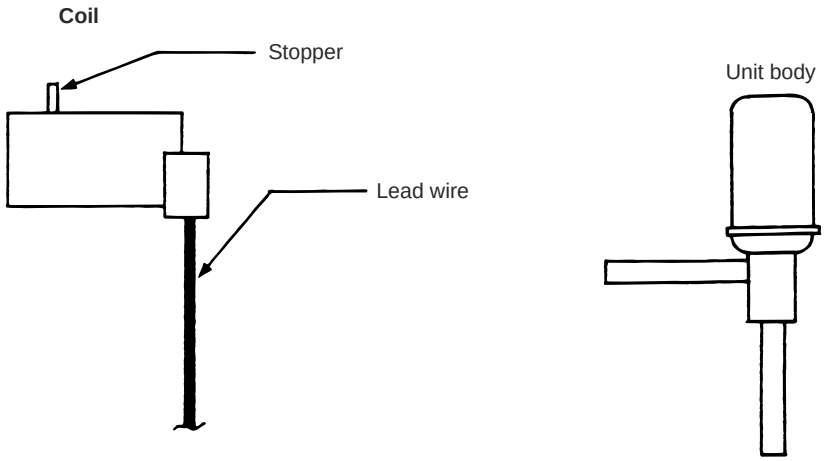
Note: The specifications of outdoor unit (Outdoor LEV) are different from those of indoor unit (Indoor LEV). For this reason, countermeasure for a failure may be different depending on the failure, take action in accordance with the subject LEV shown in the right column.

Failure mode	Failure determination method	Countermeasure	Subject LEV
Drive circuit failure of microcomputer	(1) Pull out the control board connecter to connect LED for checking shown in the figure below  When the main power is turned on, a pulse signal is output for 10 seconds for the indoor LEV and 17 seconds for outdoor LEV. If no LED remains ON or some LED remains OFF, the drive circuit is abnormal.	In case of a drive circuit failure, replace the control board.	Indoor Outdoor
Lock in portion of LEV mechanism	(1) When LED is in a locked state, the motor runs idle. At this moment, it ticks slightly. If a ticking noise generates at both closing and opening of LEV, it is a failure.	Replace the LEV.	Indoor Outdoor
Disconnection or short circuit of LEV motor coil	Measure resistance between coils (red–white, red–orange, brown–yellow, brown–blue) with a tester. When each resistance is within 150Ω±10%, it is normal.	Replace the LEV coil.	Indoor
	Measure the resistance between coils (gray–orange, gray–red, gray–yellow, gray–black) with a tester. When each resistance is within 46Ω±3%, it is normal.	Replace the LEV coil.	Outdoor
Wrong wiring or contact failure of connecter	(1) Visual check of the disconnection of the terminal block at the part of connecter and the color of lead wire (2) Pull out the connecter on the side of the control board to check its conductivity with a tester.	Check the conductivity of failure spot.	Indoor Outdoor

(4) Removing procedure for outdoor LEV

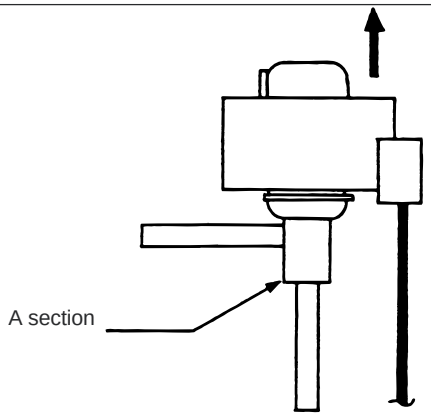
Composition (ZCAM-B25YPMD-8DA)

As shown in the illustration, the outdoor LEV is designed so that the LEV main body may be detachable from the coil.



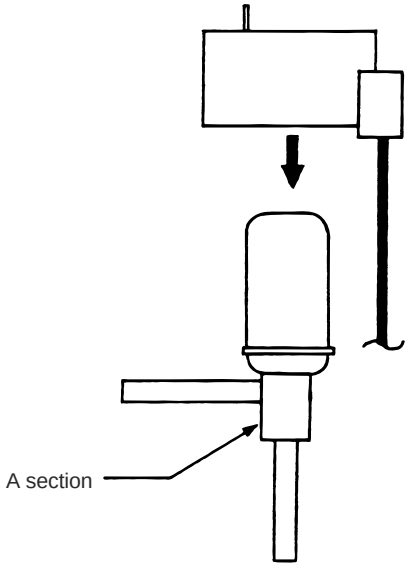
Removing procedure for coil

Firmly fix the lower part of the main body (Section A in the illustration) so that the main body may not move and pull the coil upward.
If you pull out the coil alone without holding the main body, the coil can be subject to bending force, leading to a bend in the pipe. Therefore, be sure to remove the coil firmly holding the main body.



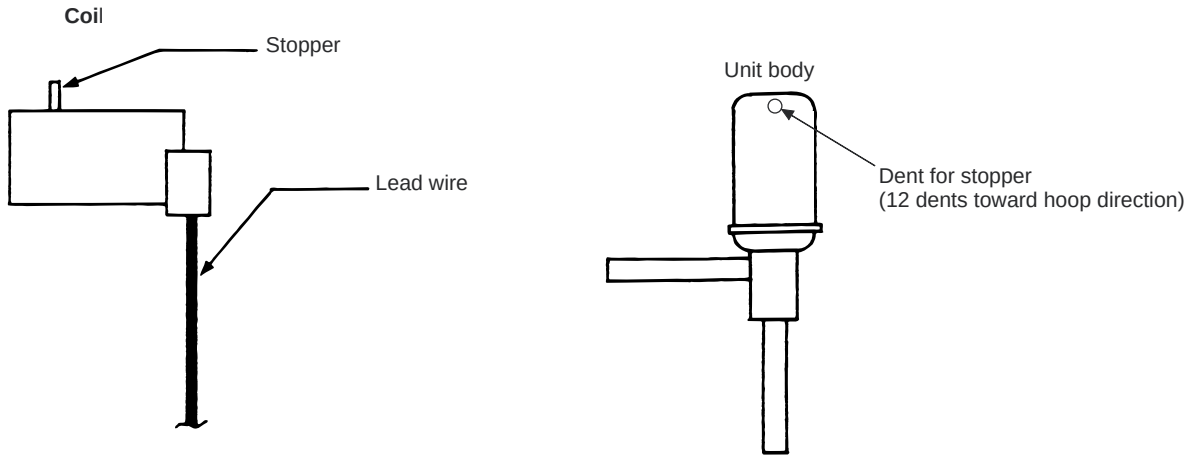
Fitting procedure for coil

Firmly fix the lower part of the main body (Section A in the illustration) so that the main body may not move and insert the coil from above and run the coil stopper in the dent.
If you pushing in the coil alone without holding the main body, the coil will be subject to bending force, leading to a bend in the pipe. Therefore, be sure to fit the coil firmly holding the main body.



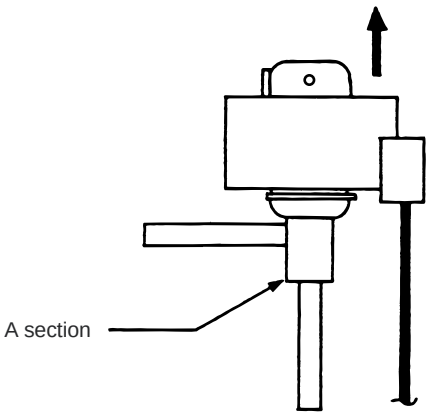
Composition (DKV-18D125)

As shown in the illustration, the outdoor LEV is designed so that the LEV main body may be detachable fro the coil.



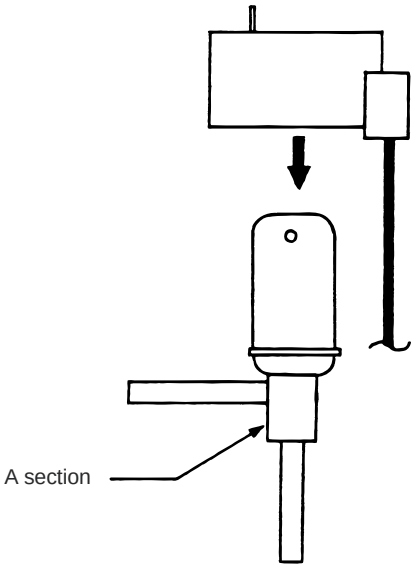
Removing procedure for coil

Firmly fix the lower part of the main body (Section A in the illustration) so that the main body may not move and pull the coil upward.
At this time, it is difficult for the coil to be pulled out due to lodging of the stopper, pull coil out upward after getting it out of the dent for the stopper on the main body by turning round the coil from side to side.
If you pull out the coil alone without holding the main body, the coil will be subject force, leading to a bend of the pipe. Therefore, be sure to remove the coil firmly holding the main body.



Fitting procedure for coil

Firmly fix the lower part of the main body (Section A in the illustration) so that the main body may not move and insert the coil from above and run the coil stopper in the dent. (Although there are 4 dents for the stopper toward hoop direction on the main body, any dent is available. However, be sure to take care that the lead wire is not subject to force or wind around the main body.)
If you drive in the coil alone without holding the main body, the coil is subject to force, leading to a bend of the pipe. Therefore, be sure to fit the coil firmly holding the main body.



5. Inverter

a. **Replace only the compressor** if only the compressor is found to be defective.
(Overcurrent will flow through the inverter if the compressor is damaged, however, the power supply is automatically cut when overcurrent is detected, protecting the inverter from damage.)
b. Replace the defective components if the inverter is found to be defective.
c. If both the compressor and the inverter are found to be defective, replace the defective components of both devices.

(1) Inverter related defect identification and countermeasures

	Error display/failure condition	Measure/inspection item
[1]	Inverter related errors (0403, 4200, 4220, 4230, 4240, 4250, 4260, 5110, 5301)	Check the details of the inverter error in the error log at the outdoor PCB LED monitor display or PC display. Perform the measures corresponding to the error code and error details determined using the remote control error display self diagnosis and countermeasures.
[2]	Main power breaker trip	a. Check the breaker capacity.
		b. Electrical system short circuit or grounding other than the inverter
		c. Refer to (3)-[1] if not a, or b.
[3]	Main power earth leakage breaker trip	a. Earth leakage breaker capacity/sensitivity current check]
		b. Meg defect for electrical system other than the inverter
		c. Refer to (3)-[1] if not a, or b.
[4]	Only the compressor does not operate.	• Check the inverter frequency at the LED monitor and proceed to (2)-[3] if the status is operational.
[5]	The compressor always vibrates strongly or emits an abnormal noise.	Go to (2)-[3].
[6]	Noise has penetrated the peripheral device.	a. Check to ensure that power supply wiring, etc. of the peripheral device is not in close contact with the power supply wiring of outdoor unit.
		b. Check to ensure that the inverter output wiring is not in close contact with the power supply wiring and transmission lines.
		c. Check to ensure that the transmission line shield wiring is being used properly in the necessary environment, and that the shield wire ground is appropriate.
		d. Meg defect for electrical system other than the inverter
		e. Attach a ferrite core to the inverter output wiring. (Please contact the factory for details of the service part settings)
		f. Change the power to another system.
		g. If this problem occurs suddenly, there is a possibility that the inverter output is grounded. Proceed to (2)-[3].
		• Contact the factory for cases other than those listed above.
[7]	Sudden malfunction (as a result of external noise.)	a. Check to ensure that the unit is grounded.
		b. Check to ensure that the transmission line shield wiring is being used properly in the necessary environment, and that the shield wire ground is appropriate.
		c. Check to ensure that the neither the transmission line or external connection wiring run close to another power supply system or run through the same conduct pipe.
		• Contact the factory for cases other than those listed above.

1. Due to a large capacity electrolytic capacitor used in the inverter, voltage still flows through even after cutting the main power, creating the possibility of electric shock. As a result, wait for a sufficient length of time (5-10 min) after cutting the main power and check the voltage at both terminals of the electrolytic capacitor to performing any checks on the inverter.
2. Damage will result to the components of IPM, etc. if the inverter wiring is not properly secured with screws, or if the connector has not been properly inserted. It is likely that any errors occurring after replacing components are the result of wiring mistakes. Ensure that the wiring, screws, connectors and Faston, etc. are properly inserted.
3. Do not remove or insert inverter connectors with the main power supply on, as this will result in damage to the PCB.
4. The current sensor will be damaged if current flows without connecting to the PCB. A lways insert connectors into the corresponding PCB when running the inverter.

(2) Treatment of inverter output related troubles

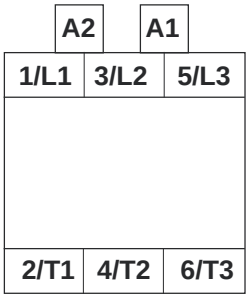
	Check item	Phenomena	Treatment
[1] Check the INV board error detection circuit.	Perform the following: ① Disconnect INV board CNDR2. After removing, turn on the outdoor unit and check the error status. (The compressor does not operate because CNDR2, which carries the IPM drive signal, has been disconnected.)	① IPM/overcurrent error. (4250 detailed No.101, 102, 103, 104, 105, 106, 107)	• Replace INV board.
		② ACCT sensor circuit error. (5301 detailed No. 6)	See to (4) "Current Sensor ACCT". Check the resistance and replace if erroneous. Replace the INV board if the ACCT status is normal.
		③ DCCT sensor circuit error. (5301 detailed No.118)	• Replace DCCT Turn on the outdoor unit again after replacing the DCCT. If an error occurs: • Replace the INV PCB (The DCCT condition can be regarded as normal.)
		④ ACCT sensor circuit error. (5301 detailed No.115)	INV board error detection circuit is normal. Because IPM can not drive, if the CNDR2 is disconnected.
[2] Check for compressor ground fault or coil error.	Disconnect the compressor wiring, and check the compressor Meg, and coil resistance.	① Compressor Meg failure Error if less than 1MΩ. • When no refrigerant is accumulated in the compressor. ② Compressor coil resistance failure Coil resistance value of 0.48Ω (20˚C)	• Replace compressor Check whether the refrigerant is accumulating in the compressor again.
[3] Checking if the inverter is broken or not. • Perform this check if an error occurs immediately before or after turning on the compressor.	Perform the following: ① Reconnect the connector removed at item [1]. ② Disconnect the compressor wiring. ③ Turn on SW1-1 on the INV board. Operate the outdoor unit after above steps. Check the inverter output voltage. • It is recommend to use the tester used to determine the (5) IPM troubleshooting when checking the inverter output voltage. • Measure when the inverter output frequency is stable.	① IPM/overcurrent error. (4250 detailed No.101, 102, 103, 104, 105, 106, 107)	• Refer to item [5] for inverter circuit trouble.
		② There is a high possibility of an inverter circuit error if the voltage unbalance across all wiring is greater than the larger of the values represented by 5% or 5V.	
		③ No voltage unbalance across all wiring	See item [2]. Proceed to item [5] however if there is no problem at [2]. Replace the compressor if there is no problem at [5].
[4] Check to see if the inverter is damaged. • Perform this check if an error occurs during steady operation.	Turn on the outdoor unit. Check the inverter output voltage. • It is recommend to use the tester used to determine the (5) IPM troubleshooting when checking the inverter output voltage. • Measure when the inverter output frequency is stable.	① There is a high possibility of an inverter circuit error if the voltage unbalance across all wiring is greater than the larger of the values represented by 5% or 5V.	• Refer to item [5] for inverter circuit trouble.
		② No voltage unbalance across all wiring	See item [2]. Proceed to item [5] however if there is no problem at [2]. Replace the compressor if there is no problem at [5].

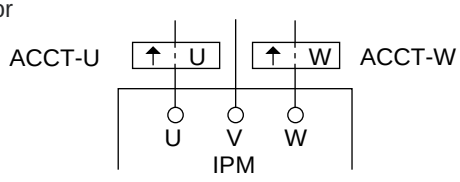
	Check item	Phenomena	Treatment
[5] Check the inverter circuit trouble.	① Check to see if the IPM screw terminal is loose.	① Screw terminal is loose.	• Check all IPM screw terminals and tighten.
	② Check the exterior of the IPM.	② IPM is cracked due to swelling.	• IPM replacement Check the operation in [3] or [4] after replacing the IPM. In the case of an output voltage unbalance or error recurrence: → Replace the G/A board In the case of an output voltage unbalance or error recurrence after replacement: → Replace the INV board
	③ Check the resistances be-tween each terminal of IPM. Refer to (5) for details on IPM troubleshooting.	③ Resistance error between each terminal of IPM.	• IPM replacement Check the operation in [3] or [4] after replacing the IPM. In the case of an output voltage unbalance or error recurrence after replacement: → Replace the G/A board In the case of an output voltage unbalance or error recurrence after replacement: → Replace the INV board
		④ All normal for items ①~③ above	• IPM replacement In the case of an output voltage unbalance or error recurrence after replacement: → Replace the G/A board In the case of an output voltage unbalance or error recurrence: → Replace the INV board

(3) Trouble measures when main power breaker tripped

	Check item	Phenomena	Treatment
[1]	Perform Meg check between the terminals in the power terminal block Tba.	① Zero to several ohm, or Meg failure.	Check each part in the main inverter circuit. • Refer to "Simple checking Procedure for individual components of main inverter circuit". a. Diode Stack b. IPM c. Rush current protection resistor d. Electromagnetic relay e. DC reactor f. Noise filter
[2]	Turn on the power again and check once more.	① Main power breaker trip	
		② No remote control display	
[3]	Turn on the outdoor unit and check that it operates normally.	① Operates normally without tripping the main breaker.	a. There is a possibility that the wiring shorted momentarily. Trace the short and repair. b. If a. above is not the case, there is a possibility that there was a compressor failure.
		② Main power breaker trip	• A compressor ground fault can be considered. Go to (2)-[2].

(4) Simple checking procedure for individual components of main inverter circuit

<table>
<tr><th>Part name</th><th>Judgement method</th></tr>
<tr><td>Diode stack</td><td>Refer to "Determining diode stack troubleshooting" (6))</td></tr>
<tr><td>IPM
(Intelligent power module)</td><td>Refer to "Determining IPM interference" (5))</td></tr>
<tr><td>Rush current protection resistor
R1, R5</td><td>Measure the resistance between terminals: 47kΩ±10%</td></tr>
<tr><td>Electromagnetic contactor (52C)</td><td>Measure the resistance value at each terminal.
 

<table>
<tr><th>Check location</th><th>Judgement value</th></tr>
<tr><td>A1 - A2</td><td>0.1k~1.3kΩ</td></tr>
<tr><td>1/L1 - 2/T1</td><td rowspan="3">∞</td></tr>
<tr><td>3/L2 - 4/T2</td></tr>
<tr><td>5/L3 - 6/T3</td></tr>
</table></td></tr>
<tr><td>DC reactor DCL</td><td>Measure the resistance between terminals: 1Ω or lower (almost 0Ω)
Measure the resistance between terminals and the chassis: ∞</td></tr>
<tr><td>Cooling fan (MF1)</td><td>Measure the resistance between terminals : 0.1k ~ 1.5kΩ</td></tr>
<tr><td>Transformar (To1)</td><td>Measure the resistance between terminals on the primary side (CNTR1) : 1.0k ~ 2.5kΩ
Measure the resistance between terminals on the secondary side (CNTR) : 20 ~ 60Ω</td></tr>
<tr><td>Current sensor
ACCT</td><td>Disconnect the CNCT2 target connector and check the resistance between terminals: 280Ω±30Ω
1-2PIN (U-phase)
3-4PIN (W-phase)
 

※ Check the ACCT connecting phase and direction.</td></tr>
</table>

(5) Intelligent power module (IPM)

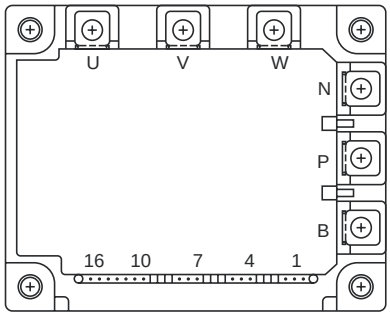
Measure resistances between each terminal of IPM with tester, and use the results for troubleshooting.

① Focus on whether there is a complete open (∞Ω) state or short-circuit (~ 0Ω).
The measured resistance value is a guideline and may deviate slightly.
Measure between several similar measurement points.
If the value does not differ by more than double or half from the other points, then judge the state as OK.

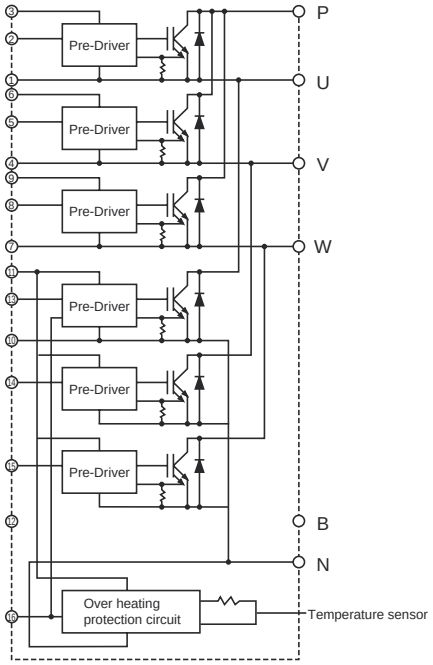
② Restrictions to applicable tester
Use a tester with an internal power of 1.5V or more.
• Battery type tester
A card tester with button battery has a low applied voltage, so the resistance value of the diode characteristics cannot be measured correctly.
Use a measurement range that measures the low resistance when possible. An accurate measurement with less fluctuation will be possible.

The measured values for troubleshooting are shown in the table below.

• External view



• Internal circuit diagram

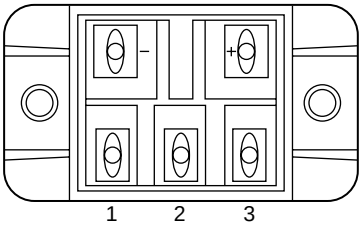


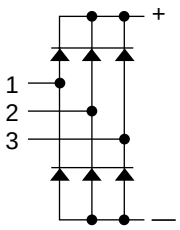
• Judged value

Tester Black / Tester Red	P	N	U	V	W
P			5~200Ω	5~200Ω	5~200Ω
N			∞	∞	∞
U	∞	5~200Ω			
V	∞	5~200Ω			
W	∞	5~200Ω			

(6) Diode stack

Perform continuity check with tester. Judged as normal if the following characteristics are observed.
(Restrictions to applicable tester are the same as those of IPM)



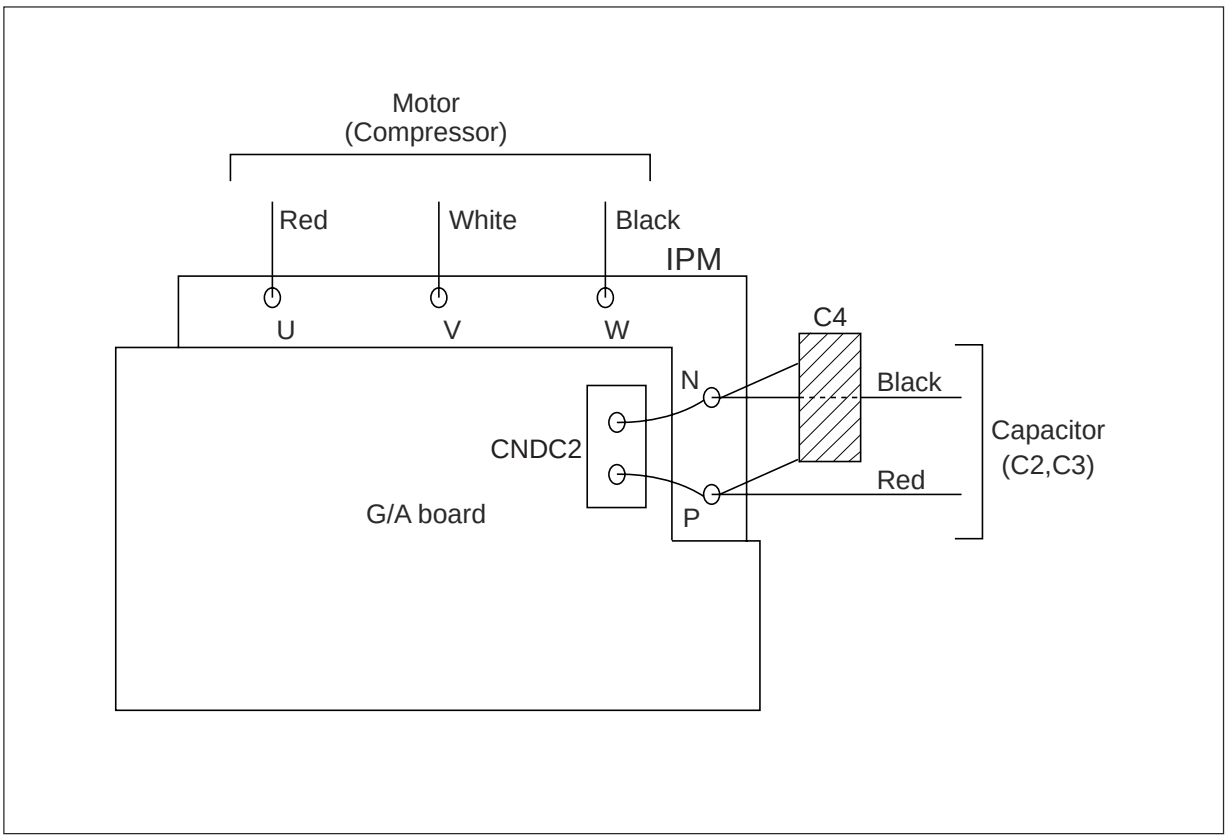


Tester Black / Tester Red	+	–	1	2	3
+			5~200Ω	5~200Ω	5~200Ω
–			∞	∞	∞
1	∞	5~200Ω			
2	∞	5~200Ω			
3	∞	5~200Ω			

(7) Caution at replacement of inverter parts

① Fully check wiring for incorrect and loose connection.
The incorrect or loose connection of the power circuit part wiring like IPM and diode module causes to damage the IPM. Therefore, check the wiring fully. As the insufficient tightening of screws is difficult to find, tighten them together additionally after finishing other works. For the wiring of the base for IPM, observe the wiring diagram below carefully as it has many terminals.

② Coat the grease for radiation provided uniformly onto the radiation surface of IPM /diode modules.
Coat the grease for radiation on the full surface in a thin layer, and fix the module securely with the screw for fastening. As the radiation grease attached on the wiring terminal causes poor contact, wipe it off if attached.



6. Control circuit

(1) Power source for control

(1) Outdoor unit controller

DC12V and DC5V derived from the bus voltage (DC280V) for the outdoor unit inverter are supplied to the main board by the DC-DC converter (INV board).

(2) Control line

The control source for indoor system (DC30V) and control source for central control system (DC30V) are provided by the DC-DC converter (INV board) from the bus voltage (DC280V) for outdoor unit inverter. Furthermore, a transmit/receive signal is superimposed to the control source.

(3) Oil trap kit

5V for micro computer and DC12V for relay derived from the power source AC200V for outdoor unit are provided by the transformer and supply circuit for stabilization. However, while the power source AC200V is shutdown, 5V for micro computer is provided by the control source (DC30V) supplied from an outdoor unit by way of the control line.

(4) MN converter

5V for micro computer is provided by the control source (DC30V) supplied from an outdoor unit by way of the control line.

(5) Indoor unit

DC5V for micro computer, LEV, and DC12V for relay are provided by the transformer and supply circuit for stabilization from the power source AC200V for indoor unit.

However, while the power source AC200V is shutdown, DC12V for LEV and 5V for micro computer are provided by the control source (DC30V) supplied from an outdoor unit by way of the control line.

(6) Remote control

DC5V for micro computer is provided by the control source DC30V (For MA remote control DC12V) supplied from an outdoor unit (For MA remote control an indoor unit) by way of the control line.

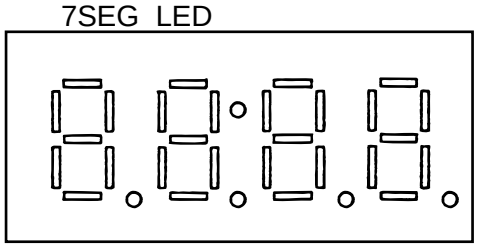
(2) Transmit/receipt system

The transmit/ receipt during Replace Multi mineral recovery operation is performed by the serial transmission with non-polar 2-wire system between remote controller ~ indoor unit ~ heat storage tank unit ~ oil trap kit ~ outdoor unit ~ MN converter (PC).

VIII. Monitor Display of Mineral Oil Recovery Operation by Outdoor Board LED

1. How to view LED for service monitor

The setting of DIP SW1–1 ~ 1–8 on the outdoor unit main board allows an operational status to be confirmed with the service LED. (As for DIP SW and corresponding items, refer to Item 2 in the synoptic table.)
As shown in the following illustration, the service LED laying out 4 sets of LEDs consisting of 7 segments is so designed that numerical values and graphs can be displayed.



Numerical display of pressure, temperature, etc. and graphical display of operational status, ON/OFF status of the solenoid valve, etc. can be displayed.

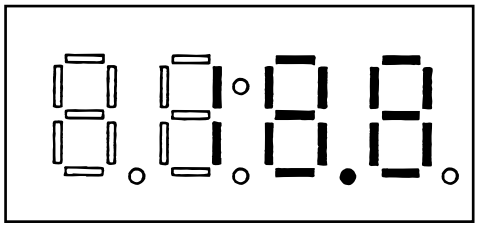
For numerical display

Example : When the pressure sensor datum is 18.8kg/cm²G (Item No. 53)

❇ The unit of pressure is kg/cm²G.

❇ Conversion formula to SI unit is as below:

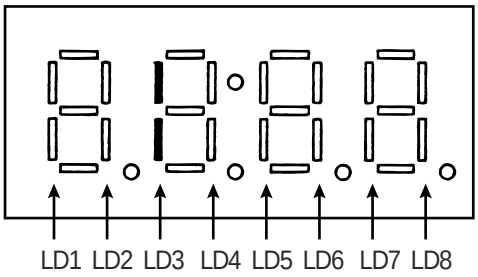
Display in SI unit (MPa) = Displayed value (kg/cm²G) x 0.098



For flag display

(A flag is expressed with 2 LEDs arranging vertically.)

Example : On 3 minute restart operation in outdoor unit operation display (Item No. 7)



2. Synoptic table of the monitor display of mineral oil recovery operation by outdoor board LED

LED monitor display

No	SW										Item	Display										Remarks
	1	2	3	4	5	6	7	8	9	10		LD1	LD2	LD3	LD4	LD5	LD6	LD7	LD8	LD9	LD10	
506	0	1	0	1	1	1	1	1	1	0	INVOutput frequency	0 ~ 9999										
507	1	1	0	1	1	1	1	1	1	0	TH1 [TH11] data	–99.9 ~ 999.9										Data for mineral oil recovery operation displayed
508	0	0	1	1	1	1	1	1	1	0	TH10 data	–99.9 ~ 999.9										
509	1	0	1	1	1	1	1	1	1	0	63HS data	–99.9 ~ 999.9										
510	0	1	1	1	1	1	1	1	1	0	63LS data	–99.9 ~ 999.9										
511	1	1	1	1	1	1	1	1	1	0	AK data	0 ~ 9999										

IX. Maintenance and Checking

1. Maintenance and checking period

Carry out maintenance and checking periodically in order to keep this product in good condition for a long time. “Checking period” for a standard maintenance and checking and “Maintenance period” accompanied by the periodical checking are shown in the following.

(1) Indication of planning maintenance

The following table shows contents of periodical checking in general conditions and its period (Checking period) and a predicted period (maintenance period) of the execution of adjustment or part replacement which would be required based on the result of periodical checking. As for adjustment, for the purpose of preventing part deterioration and performance decrement, and for parts replacement after checking, running hours and duration of service of each part which may reach a range of its wear and failure are predicted as follows.

Table-1 Maintenance and checking period

	Part name	Execution period of checking	Checking period	Maintenance period	Maintenance and checking
(1)	Strainer	At the beginning of intermediary stage	1 year	1 year	○
(2)	Solenoid valve	↑	1 year	20,000 hours	○
(3)	Pressure sensor	↑	1 year	5 years	○
(4)	Portable refractometer	↑	1 year	In case of maintenance not allowed	○

❇ Do not misunderstand that a maintenance period means a warranty period.

(2) Notes

It is necessary to consider shortening a maintenance period in the case that the following items are applied.

(1) In case of using this product at a place where temperature and humidity are high or where they vary drastically.
(2) In case of using this product at a place where power source variation (voltage, frequency, wave pattern distortion, etc.) is large. (Do not use out of permissible range)
(3) In case of using this product at a place where vibration or impact is a regular occurance.
(4) In case of using this product in a bad atmosphere, such as in harmful gas/oil mist including dust, salinity, sulfurous acid gas, and sulfured chlorine

• Even if periodical checking based on a checking period is carried out, there may be an unexpected accident. In this case, repair should still be carried out, even if trouble occurs out of the warranty period.

On holding period of parts for repairs

• The minimum holding period of parts for repairs of this product is 9 years after its discontinuation of manufacturing. This period is amenable to the guidance of Ministry of Economy, Trade and Industry (Former Ministry of International Trade and Industry). In the case that we procure parts for repairs to be able to maintain the performance of this product by the repair work, we will make repairs on it, based on customer’s request customers will be charged.

2. Maintenance and checking procedure for major parts for the oil trap kit

2-1 Preparation before checking work

(1) Parts list

Name of part	Application	Specifications (Number of pieces)	Remarks
(1) PC (Field supply)	Confirmation of solenoid valve failure	Same specifications as PC for mineral oil recovery operation	
(2) Software	Software for checking	S/W exclusively for replacement	
(3) Connection cable (Field supply)	Connection with RS-232C between the oil trap kit and PC	Same specifications as cable for mineral oil recovery operation	
(4) Powering for transmission line (Field supply)	Powering for transmission of the oil trap kit	Feed unit for transmission line 1 (PAC-SC34KUA)	
(5) Power source wiring (Field supply)	Power source supply to the oil trap kit and (4) powering unit for transmission line	Wire thickness for power ϕ1.6mm^2 (2 pieces)	
(6) Control wire (Field supply)	Connection between the oil trap kit and (4) powering unit for transmission line. (Transmission line)	Wire thickness for control ϕ1.25mm^2 (2 pieces)	

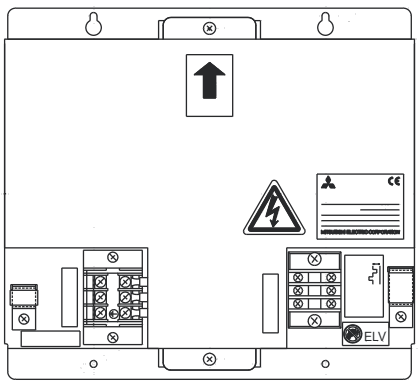
(2) Connection of electric wiring

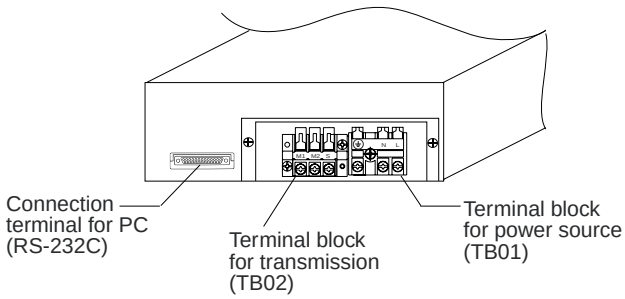
(1) Connect AC220~240V power wiring to the powering unit for transmission line and the terminal block for power source of the oil trap kit.

(2) Connect the transmission line to the terminal block for the powering unit for transmission line and the oil trap kit.

(3) Connect RS-232C connection cable corresponding to PC to the terminal block for PC connection of the oil trap kit.

Powering unit for transmission line (PAC-SC34KUA)



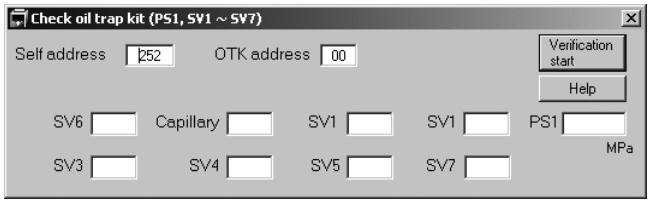


(3) Start-up procedure of S/W for checking (For use at the time of maintenance and checking of other devices than 2-2 (3) Strainer)

(1) Click “Start” button and point “Program”.

(2) Click “Oil trap kit checking” to start up S/W for checking.

(3) After starting up, input self address and OTK address to start maintenance and checking.

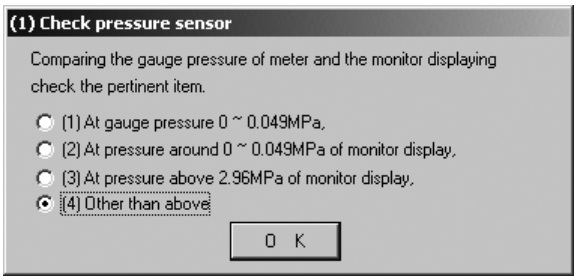


2-2 Maintenance and checking procedure (Proceed work from the top in the order.)

Charge 0.5kg of liquid refrigerant after completing maintenance and checking following the procedure below.

(1) Pressure sensor (PS1)

(1) Check the pressure comparing the pressure detected by the pressure sensor with the gauge pressure.


(1) Check pressure sensor
Comparing the gauge pressure of meter and the monitor displaying check the pertinent item.
(1) At gauge pressure 0 ~ 0.049MPa,
(2) At pressure around 0 ~ 0.049MPa of monitor display,
(3) At pressure above 2.96MPa of monitor display,
(4) Other than above
O K

a. In the state of shutdown, compare the gauge pressure with the pressure displayed on the monitor.
   1) When the gauge pressure is around 0 ~ 0.049MPa → Inner pressure drop due to gas leak
   2) When the pressure displayed on the monitor is around 0 ~ 0.049MPa → Confirm a contact failure and disconnection of the connecter and go to d.
   3) When the pressure displayed on the monitor is 2.96MPa or more → Go to c.
   4) In other cases of 1), 2), and 3), after refrigerant recovery, pressurize nitrogen gas to compare pressures → Go to b.

b. Compare the gauge pressure with the pressure displayed on the monitor in the state of nitrogen gas-pressurizing operation. After opening the ball valve (BV3), charge nitrogen gas.
   1) When the pressure difference between both pressure is 0.098MPa or less → Both the pressure sensor and main board are normal.
   2) When the pressure difference between both pressures is beyond 0.098MPa → The pressure sensor is faulty (Characteristical deterioration).
   3) When the pressure displayed on the monitor does not vary → The pressure sensor is faulty.

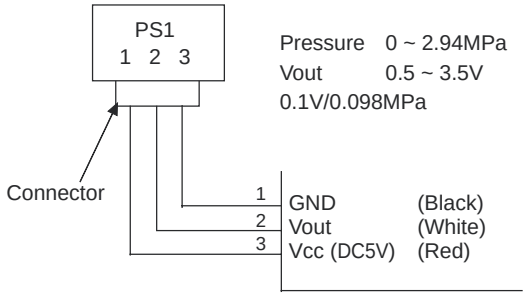
c. Remove the pressure sensor from the main board to check the pressure displayed on the monitor.
   1) When the pressure displayed on the monitor is around 0 ~ 0.098MPa → The pressure sensor is faulty.
   2) When the pressure displayed on the monitor is around 2.96MPa → The main board is faulty.

d. Remove the pressure sensor from the main board to check the pressure displayed on the monitor by a short circuit between the connecter (PS1) No. 2 and No. 3.
   1) When the pressure displayed on the monitor is 2.96MPa or more → The pressure sensor is faulty.
   2) In other cases of 1) above → The main board is faulty.

Composition of pressure sensor

The pressure sensor is composed of the circuit shown in the right. Application of 5V between the wires (Red and Black) generates an electric pressure corresponding to the pressure between the wires (White and Black) and the electric pressure is taken in the microcomputer. The output voltage is 0.1V per 0.098MPa.

❇ The main body side of pressure senor is of specifications for connecter connection.
The pin number of connecter is different to the other on the pressure sensor side and on the control board side.

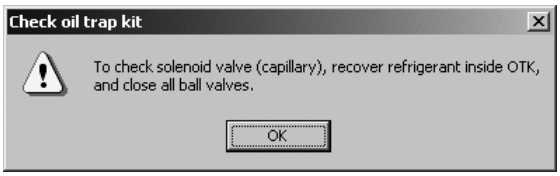


	Main body side	Main board side
Vcc	1-pin	3-pin
Vout	2-pin	2-pin
GND	3-pin	1-pin

(2) Appearance visual check
When any defect such as change in color or corrosion is found in the pressure sensor, replace it.

(2) Solenoid valve (Capillary)

Pressurize nitrogen gas to check for nitrogen leaks when the solenoid valve is acting. (Perform the work after refrigerant recovery and nitrogen gas discharge.)
Close all the ball valves (BV1 ~ 4) in the oil trap kit before charging nitrogen gas.
Additionally, shift to the next solenoid valve in case of getting an answer of “No” 3 times in succession when checking each solenoid valve.



(1) Capillary, SV6 (Selector valve), and SV1 (Bypass valve)
This solenoid valve opens when energized (Relay ON).

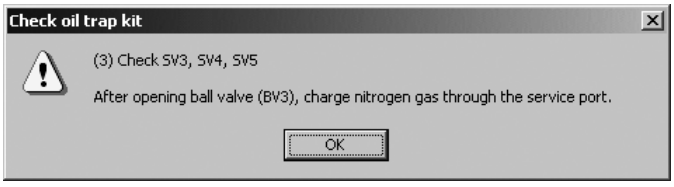
a. Charge nitrogen gas and energize the solenoid valve SV6 after opening the ball valve (BV2). (After energizing, confirm if the pressure value goes up.)
   1) After removing the tamper-proof lid, open the ball valve (BV4) to discharge nitrogen gas. → The SV6 is normal.
   2) Close the ball valve (BV4) and open the ball valve (BV1), and slightly escaping and flowing noises of nitrogen gas are audible. → The capillary (CP) is normal.
   3) Energize the solenoid valve SV1 as the above state remains as it is, and nitrogen gas escapes a little more than the above. → The SV1 is normal.
   4) Discharge nitrogen gas and put the tamper-proof lid back.

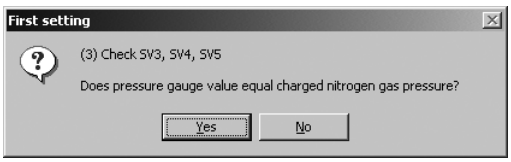
(2) SV2 (Bypass valve)
This solenoid valve opens when energized (Relay ON).

a. Charge nitrogen gas and energize the solenoid valve SV6 and SV2 after opening the ball valve (BV2).
   1) The gauge pressure of pressure gauge shows the same as the charged pressure. → The SV2 is normal.
   2) Discharge nitrogen gas.

(3) SV3, 4, and 5 (Selector valves)
This solenoid valve opens when energized (Relay ON).

a. After opening the ball valve (BV3), charge nitrogen gas and energize the solenoid valve SV3.
   1) The gauge pressure of pressure gauge shows the same as the charged pressure. → The SV3 is normal.
   2) Discharge nitrogen gas and close all of the ball valves (BV1 ~ 4).
   3) Discharge nitrogen gas
b. After performing the same work as a. and energizing the solenoid valve SV4, the gauge pressure of pressure gauge shows the same as the charged pressure. → The SV4 is normal.
c. After performing the same work as a. and energizing the solenoid valve SV5, the gauge pressure of pressure gauge shows the same as the charged pressure. → The SV5 is normal.





(4) SV7 (Selector valve)
This solenoid valve opens when energized (Relay ON).

a. After opening the ball valve (BV4), charge nitrogen gas and energize the solenoid valve SV7.
1) After removing the tamper-proof lid, open the ball valve (BV1) to discharge nitrogen gas. → The SV7 is normal.
2) Discharge nitrogen gas.

❇ When any difference from the above is found, repeat the same work. In the case that no change is observed, check each part or replace the part, if necessary. (Refer to the following items for solenoid valve confirmation.)

Confirmation items for solenoid valve (Coil)

Checking items	Judgement method	Countermeasure
Connection failure in wire connection of connecter	(1) Visual check of slipping-off of the terminal block for connecter (2) pull out the connecter on the control board side to check conductivity with a tester.	Conductivity check in troubled spots
Insulation resistance	(1) Measure insulation resistance with a 500V megger. If the insulation resistance is 1MΩ or more, it is normal.	Replace the solenoid valve coil.
Appearance	(1) Confirm if no abnormal corrosion is found visually	Replace the solenoid valve (coil).

(5) Appearance check by visual observation
When any defect such as change in color and corrosion is found in the pressure sensor, replace it.

(3) Strainer

(1) The strainer (ST3) installed between the ball valve (BV3) and the solenoid valve (SV3, 4 and 5)
Replace it at maintenance and checking. Check other strainer also referring to the following.

a. Remove the flare nut in the vicinity of the strainer to check the strainers for clogging with foreign materials. → In case of many materials clogged, check all the strainers.

b. Remove the flare nut in the vicinity of the strainer to check the strainer for their damage → When serious damage is found, check all the strainers.

(2) Visual check of appearance
When any defect such as change in color or corrosion is found in the pressure sensor, replace it.

2-3 Procedure for refrigerant recovery

There are the two ways of refrigerant recovery in the oil trap kit as shown in the following:
Before performing refrigerant recovery, be sure to confirm that no oil like mineral oil is in the oil trap kit.

(1) In case of recovery of refrigerant only in the mineral oil recovery vessel (O/S2 ~ 4)

Example : Decrease in the pressure in the oil trap kit

(1) Recover refrigerant from the check joint for service of the ball valve (BV1).

(2) In case of recovery of all refrigerant in the oil trap kit

(1) Recover refrigerant at the same time with the check joints for service of all the ball valves (BV1 ~ 4) and the ball valve (BV5) interlocked.

3. Procedure for maintenance and checking of the portable refractometer

A portable refractometer (Model: N-3000E Atago Co., Ltd.) is an optical instrument with which measurement can be done by a simple operation, making use of refraction index, based on a principle of total reflection. Accordingly, when carelessly giving a strong shock to the instrument or using it for many years, it is necessary to make a calibration correction. If maintenance and checking of the instrument not completed or found any adequacy, a correct figure can not be obtained with such a portable refractometer. Be sure to perform maintenance and checking of the portable refractometer.

Procedure for maintenance and checking:

(1) Parts to be used

Standard liquid for calibration correction LB (Liquid amount: 7ml)

(2) Procedure for calibration correction

A. Clean the prism surface and collecting plate of the portable refractometer.
B. Seep two drops of the standard liquid LB on the prism surface to measure.
C. Confirm if it is conforming to the standard amount which is shown on the label affixed on the container of standard liquid LB.
   When any discrepancy is found in the measured value, correct the calibration with the attached screwdriver.

Notes: 1. When performing the above work, be careful not to give body heat to the portable refract meter at random.
2. After the above work, firmly fasten the container cap of remaining standard liquid to keep in a cold and dark place. (Since the liquid is volatile, firmly fasten the container cap without loose.)

4. Cautions when replacing the outdoor unit main board

For specifications for operation, as Replace- Multi series has a characteristic that mineral oil recovery operation in the refrigerant pipe makes a diversion of existing pipe possible, normal operation can not be performed until the mineral oil recovery operation is completed. Information on the completion of mineral oil recovery operation is written in the memory of the main board for control accordingly. Therefore, in case of taking a wrong procedure for replacement of the main board, the following phenomenon may appear.
(When replacing only ROM, completion information of the main board is held.)

- An outdoor unit operates before mineral oil recovery operation, which may lead to a compressor trouble and shortened service life.
- Mineral oil operation can not be performed.
- After mineral oil recovery operation, an outdoor unit does not operate.

Consequently, be sure to carry out the work in the following descriptions when replacing the main board for outdoor unit.
In addition, please note that the descriptions are subject to change depending on the timing.

Timing for replacing the main board	Response procedure
• Before mineral oil recovery operation	Set the SW2-9 of main board to ON.
• After the completion of mineral oil recovery operation	Set the SW2-9 of main board to OFF

X. Information on Rating Plate

OIL TRAP KIT	
MODEL	PAC-KP90VCLU
REFRIGERANT	R407C
WEIGHT	76kg
ALLOWABLE PRESSURE (Ps)	HP 2.94MPa, LP 1.6MPa
MANUFACTURER	MISTUBISHI ELECTRIC CORPORATION AIR-CONDITIONING & REFRIGERATION SYSTEMS WORKS 5-66, TEBIRA, 6-CHOME, WAKAYAMA CITY, JAPAN